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ISO 3864-1

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Graphical symbols — Safety colours and safety signs —

Part 1: Design principles for safety signs in workplaces and public areas

Symboles graphiques — Couleurs de sécurité et signaux de sécurité —

Partie 1: Principes de conception pour les signaux de sécurité sur les lieux de travail et dans les lieux publics

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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 3.

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.

Attention is drawn to the possibility that some of the elements of this part of ISO 3864 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 3864-1 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 7010, cancels and replaces ISO 3864:1984, 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 in workplaces and public areas*

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

The following part is under preparation:

— *Part 3: Design criteria for graphical symbols used in safety signs*

Annex A of this part of ISO 3864 is for information only.

This corrected version of ISO 3864-1:2002 incorporates the following corrections:

— the addition on page 1 of an important remark on the use of the colours represented within;

— the addition in Table A.1 of details of the RAL colour order system;

— the addition of bibliographic references.

Introduction

There is a need to standardize the system for conveying safety information so that it relies as little as possible on the use of words to achieve understanding. As a consequence of continued growth in international trade, travel and mobility of labour, it has become necessary to establish a universal communications method for conveying safety information.

Lack of standardization can lead to confusion and even accidents. Education is an essential part of any system that provides safety information.

Although safety colours and safety signs are essential to any safety information system, they cannot replace the use of proper working methods, instructions and accident-prevention measures and training.

Graphical symbols — Safety colours and safety signs —

Part 1:
Design principles for safety signs in workplaces and public areas

IMPORTANT — The colours represented in the electronic file of this part of ISO 3864 can be neither viewed on screen nor printed as true representations. Although the copies of this part of ISO 3864 printed by ISO have been produced to correspond (with an acceptable tolerance as judged by the naked eye) to the colour requirements, it is not intended that these printed copies be used for colour matching. Instead, refer to the colorimetric and photometric properties specified in Clause 11. Annex A provides references from colour order systems for information.

1 Scope

This International Standard establishes the safety identification colours and design principles for safety signs to be used in workplaces and in public areas for the purpose of accident prevention, fire protection, health hazard information and emergency evacuation. It also establishes the basic principles to be applied when developing standards containing safety signs.

This part of ISO 3864 is applicable to workplaces and all locations and all sectors where safety-related questions may be posed. However, it is not applicable to the signalling used for guiding rail, road, river, maritime and air traffic and, generally speaking, to those sectors subject to a regulation which may differ.

NOTE Some countries statutory regulations might differ in some respect from those given in this part of ISO 3864.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 3864. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 3864 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 7000, *Graphical symbols for use on equipment — Index and synopsis*

ISO 7001, *Public information symbols*

ISO 7010, *Graphical symbols — Safety colours and safety signs — Safety signs used in workplaces and public areas*

ISO 9186, *Graphical symbols — Test methods for judged comprehensibility and for comprehension*

ISO/CIE 10526, *CIE standard illuminants for colorimetry*

CIE 15.2, *Colorimetry*, second edition

CIE 54, *Retroreflection — Definition and measurement*

IEC 60050-845:1987, *International electrotechnical vocabulary (IEV) — Chapter 845: Lighting*

IEC 60417 database, *Graphical symbols for use on equipment* [Available at <http://domino.iec.ch/iec60417>]

3 Terms and definitions

For the purposes of this part of ISO 3864, the following terms and definitions apply.

3.1
coefficient of retroreflection
R'
〈plane retroreflecting surface〉 luminous intensity (I) of a plane retroreflecting material in the direction of observation divided by the product of the illuminance ($E_\perp$) of the retroreflecting surface on a plane perpendicular to the direction of the incident light and its area (A)

$$R' = \frac{I}{E_\perp A}$$

3.2
combined material
material which combines the optical characteristics of photoluminescent and retroreflective materials

3.3
critical detail
element of a graphical symbol without which the graphical symbol cannot be understood

3.4
fluorescence
photoluminescence in which the emitted optical radiation results from direct transitions from the photo-excited energy level to a lower level, these transitions taking place generally within 10 ns after the excitation

[IEC 60050-845-04-20:1987]

3.5
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

$$k = \frac{L_1}{L_2}$$

3.6
luminance factor
ratio of the luminance of the surface element in a given direction to that of a perfect reflecting or transmitting diffuser identically illuminated

3.7
luminescence
emission, by atoms, molecules or ions in a material, of optical radiation which for certain wavelengths or regions of the spectrum is in excess of the radiation due to thermal emission from that material at the same temperature, as a result of these particles being excited by energy other than thermal agitation

[IEC 60050-845-04-18:1987]

3.8
ordinary material
material which is neither retroreflecting nor luminescent

3.9
retroflecting material
material which reflects radiation in a direction close to the opposite of the direction from which it came

3.10
phosphorescence
photoluminescence delayed by storage of energy in an intermediate energy level

[IEC 60050-845-04-23:1987]

3.11
photoluminescence
luminescence caused by absorption of optical radiation

[IEC 60050-845-04-19:1987]

3.12
safety colour
colour with special properties to which a safety meaning is attributed

NOTE Properties of safety colours are given in clause 11.

3.13
safety marking
marking which adopts the use of safety colours and/or safety contrast colours to convey a safety message or render an object or location conspicuous

3.14
safety sign
sign which gives a general safety message, obtained by a combination of a colour and geometric shape and which, by the addition of a graphical symbol, gives a particular safety message

3.15
supplementary sign
sign that is supportive of another sign and the main purpose of which is to provide additional clarification

4 Purpose of safety colours and safety signs

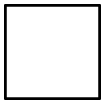
4.1 The purpose of safety colours and safety signs is to draw attention rapidly to objects and situations affecting safety and health and to gain rapid understanding of a specific message.

4.2 Safety signs shall be used only for instructions which are related to safety and health.

5 General meaning of geometric shapes and safety colours

The general meaning assigned to geometric shapes, safety colours and contrast colours for safety signs is given in Table 1.

Table 1 — General meaning of geometric shapes, safety colours and contrast colours

Geometric shape	Meaning	Safety colour	Contrast colour	Graphical symbol colour	Example of use
 Circle with diagonal bar	Prohibition	Red	White[a]	Black	— No smoking — No unauthorized vehicles — Do not drink
 Circle	Mandatory action	Blue	White[a]	White	— Wear eye protection — Wear personal protective equipment — Switch off before beginning work
 Equilateral triangle	Warning	Yellow	Black	Black	— Danger hot surface — Danger acid — Danger high voltage
 Square  Rectangle	Safe condition Means of escape Safety equipment	Green	White[a]	White	— First aid room — Fire exit — Fire assembly point
 Square  Rectangle	Fire safety	Red	White[a]	White	— Fire alarm call point — Fire fighting equipment — Fire extinguisher
 Square  Rectangle	Supplementary information	White or the colour of the safety sign	Black or the contrast colour of the relevant safety sign	Symbol colour of the relevant safety sign	As appropriate to reflect message given by graphical symbol

[a] The contrast colour white includes the contrast colour for phosphorescent material under daylight conditions with properties as defined in Table 4.

6 Process for standardization and design principles to be used for the development of safety signs

The process of development of graphical symbols for safety signs for possible future inclusion in ISO 7010 shall start with the clear definition of the specific message to be communicated and other details required for the completion of the application form for the standardization of safety signs. The proposed sign variants shall be designed according to the colour, geometric shape and other criteria of this part of ISO 3864.

Following the submission of the application form to ISO/TC 145, a search is carried out within ISO sources and from member countries for existing symbols or other variants from national and international sources. In the case that only one variant is defined, graphic designers from member countries shall be encouraged to offer alternatives.

The process for selection of variants for comprehension testing according ISO 9186 shall be as follows:

— in a collection of variants with very similar content reduce to one variant;

— exclude variants already tested/included in ISO 7000, ISO 7001 and IEC 60417;

— ensure colour and shape conform to the grammar of ISO 3864-1;

— exclude variants which offer a strong possibility of confusion due to graphic similarity or duplication with standardized graphical symbols or graphic elements.

The criteria of acceptability for standardization are given in ISO 7010.

7 Layout of safety signs

7.1 General

The safety colours, contrast colours and geometric shapes (see clause 5) shall be used only in the following combinations to obtain the five basic types of safety signs (see Figures 1 to 7).

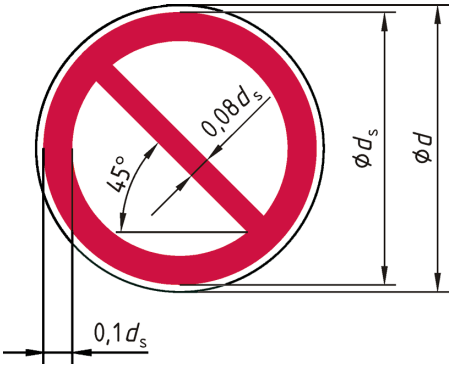
Where a graphical symbol is not available to indicate a particular desired meaning, the meaning shall be obtained preferably by using the appropriate general sign together with a supplementary sign (see Figures 8 to 16).

Borders are recommended to achieve contrast between the safety and/or supplementary sign and the surrounding. The value of the border is 0,025 to 0,05 of the geometric shape as shown in Figures 1 to 9 and using the dimensions "a_s" for rectangular signs. For practical reasons d is equal to d_s and b is equal to b_s within a tolerance of 5 %.

The borders of transilluminated safety signs shall not have a luminance greater than the contrast colour.

7.2 Prohibition signs

Prohibition signs shall comply with the layout requirements given in Figure 1.



The colours of the sign shall be as follows:

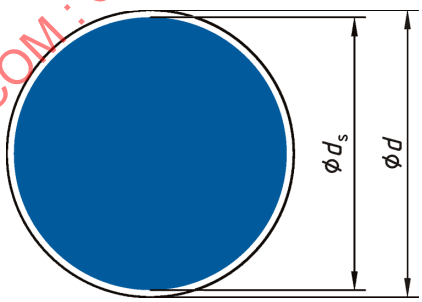
Background colour:	white
Circular band and diagonal bar:	red
Graphical symbol:	black
Border:	white

The safety colour red shall cover at least 35 % of the total area of the sign.

Figure 1 — Layout requirements for a prohibition sign

7.3 Mandatory action signs

Mandatory action signs shall comply with the layout requirements given in Figure 2.



The colours of the sign shall be as follows:

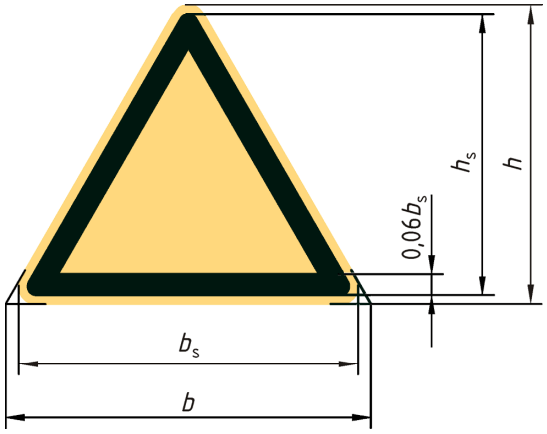
Background colour:	blue
Graphical symbol:	white
Border:	white

The safety colour blue shall cover at least 50 % of the area of the sign.

Figure 2 — Layout requirements for a mandatory action sign

7.4 Warning signs

Warning action signs shall comply with the layout requirements given in Figure 3.



The colours of the sign shall be as follows:

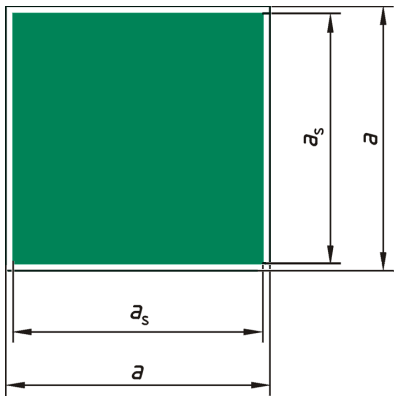
Background colour:	yellow
Triangular band:	black
Graphical symbol:	black
Border:	yellow or white

The safety colour shall cover at least 50 % of the total area of the sign.

Figure 3 — Layout requirements for a warning action sign

7.5 Safe condition signs

Safe condition signs shall comply with the layout requirements given in Figures 4 or 5.

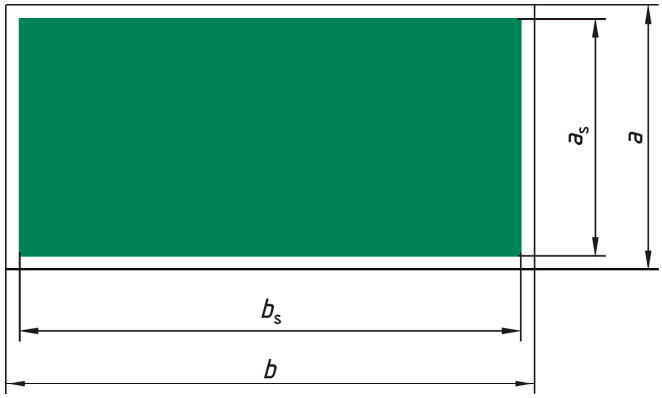


The colours of the sign shall be as follows:

Background colour:	green
Graphical symbol:	white
Border:	white

The safety colour green shall cover at least 50 % of the area of the sign.

Figure 4 — Layout requirements for a square safe condition sign



The colours of the sign shall be as follows:

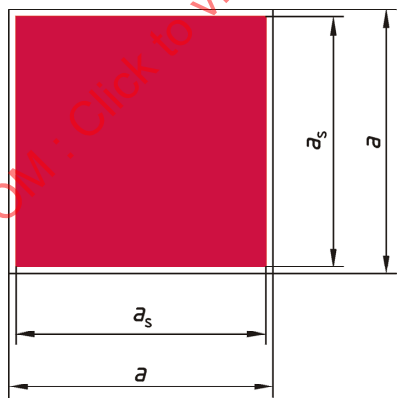
Background colour:	green
Graphical symbol:	white
Border:	white

The safety colour green shall cover at least 50 % of the area of the sign.

Figure 5 — Layout requirements for a rectangular safe condition sign

7.6 Fire safety signs

Fire safety signs shall comply with the layout requirements given in Figures 6 or 7.

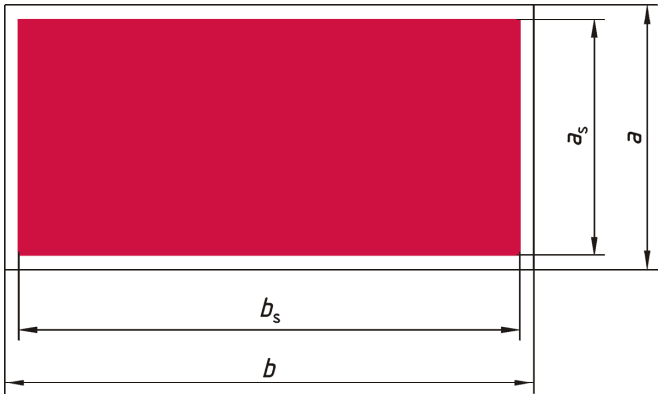


The colours of the sign shall be as follows:

Background colour:	red
Graphical symbol:	white
Border:	white

The safety colour red shall cover at least 50 % of the area of the sign.

Figure 6 — Layout requirements for a square fire safety sign



The colours of the sign shall be as follows:

Background colour:	red
Graphical symbol:	white
Border:	white

The safety colour red shall cover at least 50 % of the area of the sign.

Figure 7 — Layout requirements for a rectangular fire safety sign

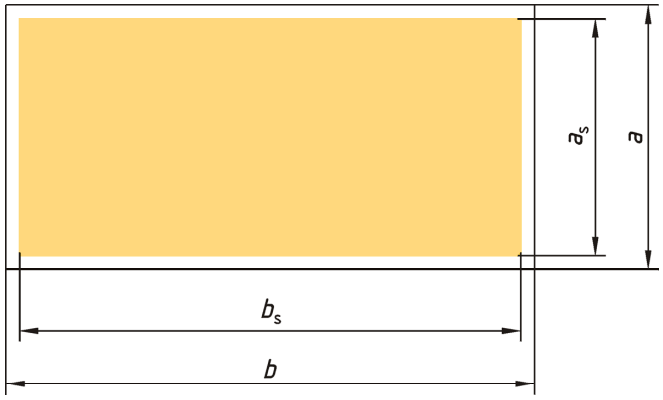
8 Layout of supplementary, combination and multiple signs

8.1 General

Text may be used to supplement or clarify the meaning of the graphical symbol(s) used on a safety sign. Text shall be either placed in a separate supplementary sign or included as part of a combination sign.

8.2 Supplementary signs

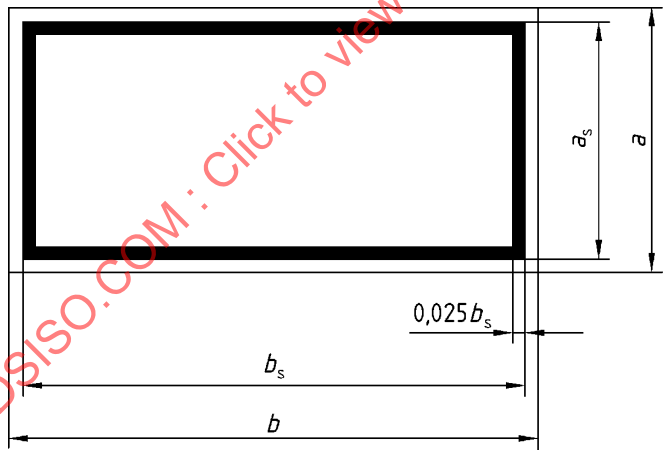
Supplementary signs shall comply with the layout requirements given in Figure 8 or 9.



The colours of the sign shall be as follows:

Background colour:	white or safety colour of the safety sign
Symbol or text colour:	relevant contrast colour
Border:	white

Figure 8 — Layout requirements for a supplementary sign



The colours of the sign shall be as follows:

Background colour:	white or safety colour of the safety sign
Symbol or text colour:	relevant contrast colour
Border:	white
Boundary:	black

Figure 9 — Layout requirements for a supplementary sign with boundary

8.3 Position assignment of a supplementary sign

The positions of the supplementary sign are shown in Figure 10. The supplementary sign shall be placed below (see Figure 11), to the right (see Figure 12) or to the left of the safety sign.

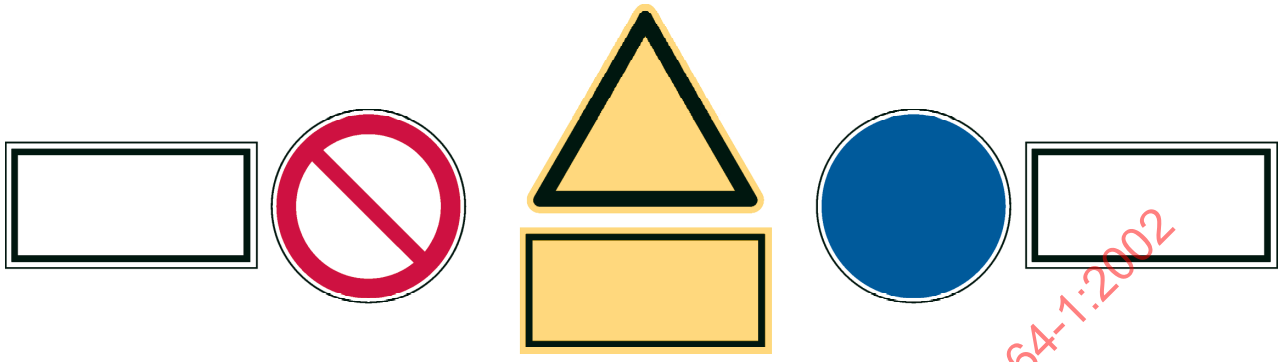
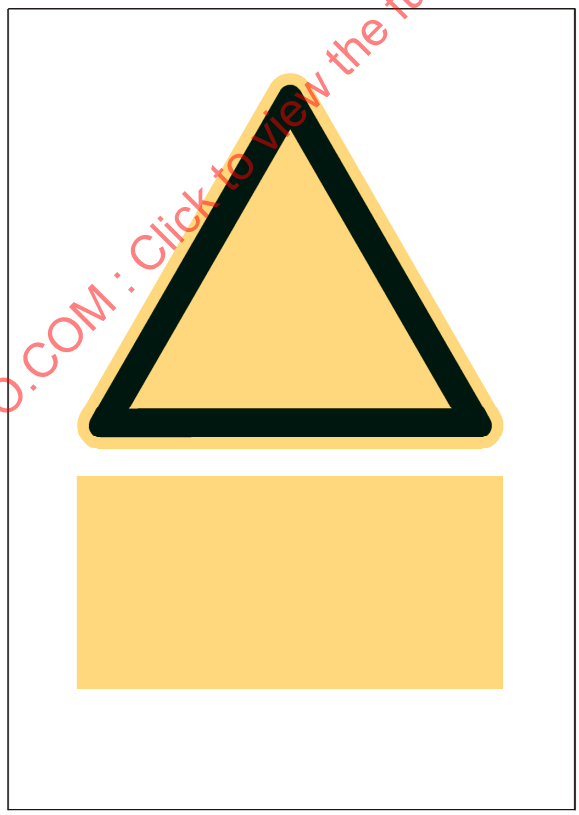


Figure 10 — Position assignment of a supplementary sign

8.4 Combination signs

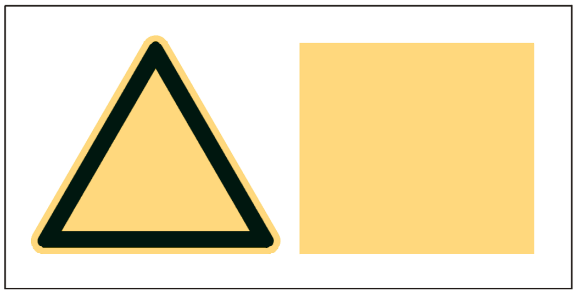
Combination signs contain the safety sign and the supplementary sign on one rectangular carrier. Examples are shown in Figures 11 and 12.



The colours of the sign shall be as follows:

Colour of sign carrier:	colour of the safety sign or white
Symbol or text colour:	relevant contrast colour

Figure 11 — Layout for a combination sign with the supplementary sign below the safety sign



The colours of the sign shall be as follows:

Colour of sign carrier:	colour of the safety sign or white
Symbol or text colour:	relevant contrast colour

Figure 12 — Layout for a combination sign with the supplementary sign to the right of the safety sign

8.5 Multiple signs as a means of communicating complex safety messages

A multiple sign is a combination sign containing two or more safety signs and/or associated supplementary signs on the same rectangular carrier. An example of a layout for a multiple sign used to communicate a warning, a mandatory instruction to avoid risk of injury and/or provide a prohibition message is given in Figure 13.

In multiple signs, the order of the safety signs (and/or the corresponding supplementary signs) should be arranged according to the importance of the safety messages. A horizontal layout may also be used.

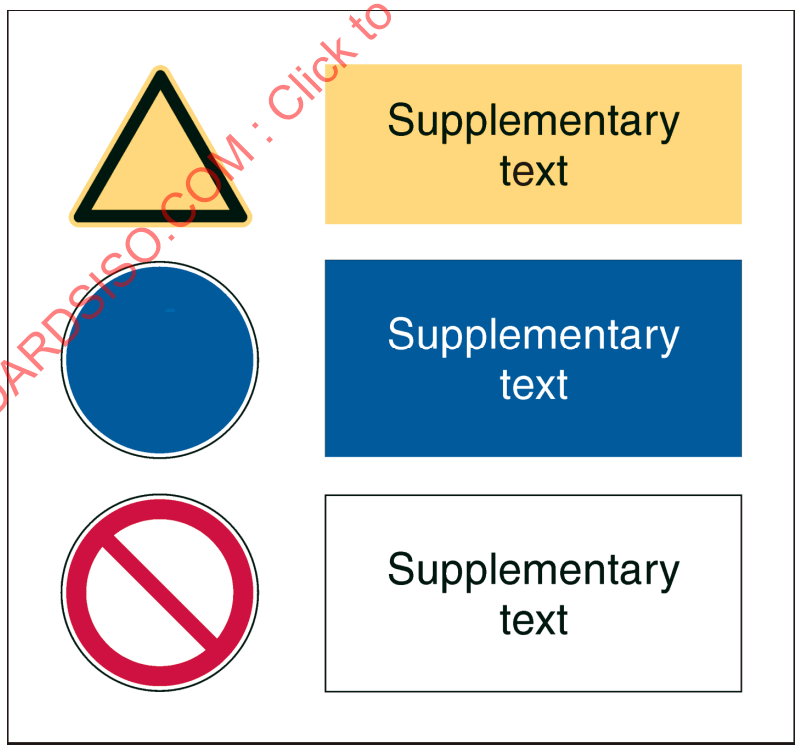


Figure 13 — Example of a layout for a multiple sign

8.6 Combination signs using the supplementary sign depicting an arrow, with and without supplementary text signs

A graphical symbol sign, a supplementary sign and a supplementary directional arrow sign may be combined to provide a comprehensive directional safety message. Examples are given in Figures 14 to 16.

A combination sign on one carrier may omit internal borders.

Directional arrows shall be placed above or below or to the left or right of the safety sign.

Figure 14 — Example of a combination sign with directional arrows on left

Figure 15 — Combination sign with directional arrows on right: Example 1

Figure 16 — Combination sign with directional arrows on right: Example 2

9 Layout of safety marking

The bands are of equal width inclined at an angle of approximately 45° (see Figures 17 to 20).

The colours of safety marking which indicate hazard locations shall be a combination of yellow and contrast black as shown in Figure 17.

Colour combination: yellow and contrast black

Figure 17 — Safety marking for indicating hazard locations

The colours of safety marking which indicate prohibition or location of fire fighting equipment shall be a combination of red and contrast white as shown in Figure 18.

Colour combination: red and contrast white

Figure 18 — Safety marking for indicating prohibition or location of fire fighting equipment

The colours of safety marking which indicate a mandatory instruction shall be a combination of blue and contrast white as shown in Figure 19.

Colour combination: blue and contrast white

Figure 19 — Safety marking for indicating a mandatory instruction

The colours of safety marking which indicate a safe condition shall be a combination of green and contrast white as shown in Figure 20.

Colour combination: green and contrast white

Figure 20 — Safety marking for indicating a safe condition

10 Relationship between dimensions of safety signs and distance of observation

The relationship between the greatest distance from which the safety sign is legible and conspicuous in shape and colour and the height of the safety sign together with the distance factor Z is given by the following equation:

$$h = l / Z$$

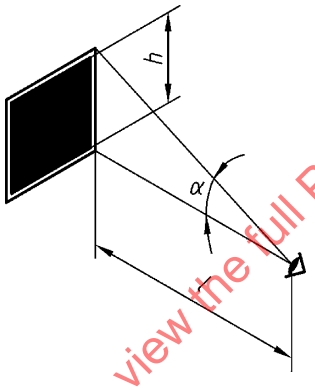
where

l is the distance of observation;

h is the height of the sign;

Z is the factor of distance = 1 / tan α;

and h and l have the same units (see Figure 21).



l distance of observation
h height of the sign
Z factor of distance = 1 / tan α
α angular extension of the sign (tan $\alpha = h / l$)

Figure 21 — Example for the angular extension of a safety sign

For the height h of the sign take (shown in Figures 1 to 9):

— d_s for prohibition and mandatory signs,

— h_s for warning signs,

— a_s for safe condition signs, fire safety signs and supplementary signs.

The factor Z depends on the height of the sign, the size of the critical details, the luminance of the sign and its contrast against the surrounding.

The ratio r as a quotient of the height of the sign to that of the size of the critical detail shall be 15 or less. Where r is greater than 15, the value of Z shall be corrected by a multiplication factor of 15/r.

Under this geometric condition, the uncorrected factor of distance Z valid for illuminated signs shall be 100 if the incident illuminance of the sign's surface is more than 50 lx and preferably more than 80 lx.

Transilluminated exit signs and directional escape route signs with average luminance of the contrast colour greater than 500 cd/m^2 shall double the factor of distance and therefore the observation distance. They also shall be sufficiently conspicuous in bright surroundings. In dark surroundings, the luminance shall be reduced to avoid glare or disturbance.

NOTE 1 The above calculations are based on the statistical probability that 95 % of the people can reliably detect the sign, reliably resolve the colour and reliably resolve the critical detail of the safety sign.

NOTE 2 For safety colour luminances lower than 2 cd/m^2 (mesopic range of luminances), the colour rendition is considerably reduced. The observation distance is also reduced at luminances of 100 mcd/m^2 for instance by the factor 4 compared with illuminated signs under normal lighting conditions. For even lower luminances in the scotopic range of luminances, a colour rendition is totally impossible. The observation distance in the scotopic range at luminances of 5 mcd/m^2 for instance is reduced by the factor of 18 compared with illuminated signs under normal lighting conditions.

11 Colorimetric and photometric properties of safety colours and contrast colours

11.1 Conditions

The physical requirements that safety signs have to meet are primarily related to daytime colour.

Measurements of chromaticity coordinates and luminance factor β shall be made as specified in CIE 15.2.

For the measurement of chromaticity coordinates and luminance factor β of ordinary, luminescent and retroreflecting externally illuminated signs, the material is considered to be illuminated by daylight as represented by the standard illuminant D65 (see IEC 60050-845-03-12 and ISO/CIE 10526) at an angle of 45° with the normal to the surface and the observation made in the direction of the normal (45/0 geometry).

For internally illuminated signs, the measurement has to be done with a colorimeter according to the measurement of luminaires. The sign has to be transilluminated by the light source provided by the manufacturer.

The coefficient of retroreflection shall be measured in accordance with CIE 54, using standard illuminant A (ISO/CIE 10526), with the condition that the entrance and observation angles are in the same plane.

11.2 Requirements

The permitted colour areas for safety signs shall be as shown in Figure 22 and Table 2. Colours that do not meet these chromaticity coordinates shall not be used for safety signs.

Signs may be offered as meeting precise colour requirements, in which case they shall also conform to the requirements of Table 3.

NOTE The colours of safety signs meeting the requirements of Table 3 are likely to take longer to deteriorate and therefore remain within the limits specified in Table 2 for longer.

Contrast colours and luminance factors for phosphorescent colours shall be as shown in Figure 22 and Table 4.

Table 5 contains the minimum coefficients of retroreflection for retroreflecting materials.

For transilluminated signs, the x and y coordinates shall be in the colour area given in Table 2 and the luminance contrast as given in Table 6.

The appearance of safety signs (combination of the specific colour, geometric shape and graphical symbol) shall maintain the same meaning under all lighting conditions specified as appropriate by the sign manufacturer.

Annex A gives practical information about safety colours.