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Graphical symbols — Safety colours and safety signs —

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

Symboles graphiques — Couleurs de sécurité et signaux de sécurité —

Partie 3: Principes de conception pour les symboles graphiques utilisés dans les signaux de sécurité

Reference number
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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.

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

ISO 3864-3 was prepared by Technical Committee ISO/TC 145, *Graphical symbols*, Subcommittee SC 2, *Safety identification, signs, shapes, symbols and colours*.

This second edition cancels and replaces the first edition (ISO 3864-3:2006), 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*

This corrected version of ISO 3864-3:2012 incorporates the following corrections:

— Figure 13: The size of the lower graphical symbol has been corrected.

— Figure 14: The size of the lower graphical symbol has been corrected.

— Figure A.4: The human figures have been replaced with those drawn in accordance with the template in Figure A.3.

— Figure A.17: The figure has been enlarged.

Introduction

Graphical symbols in safety signs are used for a wide range of purposes. There is a need to standardize the principles for creating these graphical symbols to ensure visual clarity, to maintain consistency, and thereby to improve recognition and comprehension. The principles set forth in this part of ISO 3864 are the design criteria by which graphical symbols are judged for standardization and publication in ISO 7010 and in ISO 20712-1.

Graphical symbols used in safety signs are not always intuitively understood. Often training needs to take place to inform people about the meaning of a graphical symbol. Such training can take place by including the meaning of a graphical symbol in operation manuals, company bulletins, training programme materials, as well as using supplementary text with the safety sign.

NOTE Information on procedures, criteria of acceptability, safety sign templates and application of safety signs is given on the website: http://www.iso.org/tc145/sc2.

Graphical symbols — Safety colours and safety signs —

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

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 requirements of ISO 3864-4, it is not intended that these printed copies be used for colour matching. Instead, consult ISO 3864-4, which provides colorimetric and photometric properties together with, as a guideline, references from colour order systems.

1 Scope

This part of ISO 3864 gives principles, criteria and guidance for the design of graphical symbols for use in safety signs as defined in ISO 3864-1, and for the safety sign element of product safety labels as defined in ISO 3864-2.

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 3864-1:2011, *Graphical symbols — Safety colours and safety signs — Part 1: Design principles for safety signs and safety markings*

ISO 3864-2, *Graphical symbols — Safety colours and safety signs — Part 2: Design principles for product safety labels*

ISO 3864-4:2011, *Graphical symbols — Safety colours and safety signs — Part 4: Colorimetric and photometric properties of safety sign materials*

ISO 7010, *Graphical symbols — Safety colours and safety signs — Registered safety signs*

ISO 17724, *Graphical symbols — Vocabulary*

ISO 20712-1, *Water safety signs and beach safety flags — Part 1: Specifications for water safety signs used in workplaces and public areas*

3 Terms and definitions

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

3.1
determinant
graphical symbol used as a common element within a series of graphical symbols

NOTE For example, the fire determinant which, when used with the graphical symbol for a hose reel, conveys the meaning “fire hose reel”; see Figure 17.

4 Designing graphical symbols for use in safety signs

Before designing a graphical symbol the designer shall:

— develop a clear and unambiguous description of the hazard that the graphical symbol is intended to address;

— confirm that a new graphical symbol for use in a safety sign is required (i.e. confirm that a suitable graphical symbol does not already exist) (see Clause 5);

— identify the safety message that the safety sign is intended to convey;

— define the characteristics of the target group, including their general skill and ability to understand the information that the particular safety sign is intended to convey, and design the graphical symbol for that group;

— assign a meaning and function to the safety sign in accordance with Clause 6;

— identify the type of the safety sign required in accordance with 7.1.

Consideration should be given as to the types of safety sign for which the graphical symbol can be appropriate and to the design implications such multiple applicability can have. For example, a graphical symbol for use in a mandatory action sign can be adversely affected by the diagonal bar of a prohibition sign. Also, the restricted space within the triangle of a warning sign can adversely affect the graphical symbol originally designed for a prohibition sign.

During the creation process, the designer shall follow the criteria given in Clause 7.

Designers are strongly recommended to use the guidelines set out in Annex A.

5 Review of existing standards

The designer shall determine:

— whether a safety sign incorporating a graphical symbol conveying the required meaning is specified in ISO 7010 or ISO 20712-1;

— in the case where a safety sign incorporating a graphical symbol conveying the required meaning is not specified in ISO 7010 or ISO 20712-1, whether there is a registered graphical symbol conveying the required meaning;

— whether registered graphical symbols with similar meanings might be adapted or combined to form the graphical symbol for the new safety sign;

— whether there are standardized determinants appropriate for use with the graphical symbol for the new safety sign (see 7.8).

If specific graphical elements are borrowed from existing graphical symbols, they should convey the same meaning as that described in the existing graphical symbol.

6 Assignment of Meaning, Function, Image content and Hazard to the safety sign

Each safety sign shall be used to convey only one safety message in accordance with ISO 3864-1.

The new safety sign shall be assigned a meaning and a function. The hazard shall be described. Once the safety sign original is complete, the image content shall be identified. An example is shown in Figure 1.

Meaning: No smoking

Function: To prohibit smoking

Image content: Cigarette (profile, outlined) with two wavy lines

Hazard: Fire or explosion caused by lit cigarettes or other smoking materials or harm from the smoke

Figure 1 — Example of assignment of Meaning, Function, Image content and Hazard to a safety sign (ISO 7010-P002)

7 Design criteria

7.1 Geometric shapes and colours of safety signs

The graphical symbol shall be designed within the appropriate safety sign template. The safety sign templates used by the designer shall conform to the geometrical shapes and colours given in ISO 3864-1:2011:

— for prohibition: see Figure 1 of ISO 3864-1:2011;

— for mandatory action: see Figure 2 of ISO 3864-1:2011;

— for warning: see Figure 3 of ISO 3864-1:2011;

— for safe condition: see Figure 4 of ISO 3864-1:2011;

— for fire equipment: see Figure 5 of ISO 3864-1:2011.

For safety signs, the colorimetric and photometric properties of the colours shall be in accordance with ISO 3864-4.

7.2 Size and position of the graphical symbol

The graphical symbol shall make full use of the central area up to the boundary of the exclusion zone of the applicable safety sign template (see 7.4) and shall be centred as close as practicable within the applicable geometric shape of the safety sign template. For examples see Figures 2 to 6.

Figure 2 — No thoroughfare (ISO 7010-P004)

A supplementary text sign is required with the general mandatory action sign.

Figure 3 — General mandatory action sign (ISO 7010-M001)

Figure 4 — Warning; Floor-level obstacle (ISO 7010-W007)

Figure 5 — Emergency telephone (ISO 7010-E004)

Figure 6 — Fire extinguisher (ISO 7010-F001)

7.3 Layout of templates

The new safety sign original shall be provided without borders in a uniform 70 mm size with corner marks to enable accurate enlargement and reduction (see Figure 7).

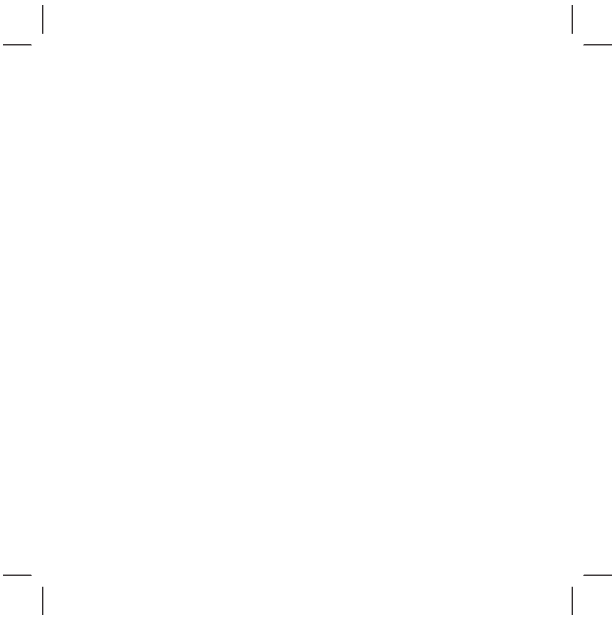


Figure 7 — Area of 70 mm size marked with corner marks (empty)

The safety sign shall make full use of the area within the corner marks such that:

— mandatory action signs and prohibition signs are circles of 70 mm diameter;

— safe condition signs and fire equipment signs are squares with 70 mm sides;

— warning signs are triangles of 70 mm in width of the base.

7.4 Exclusion zone

7.4.1 General

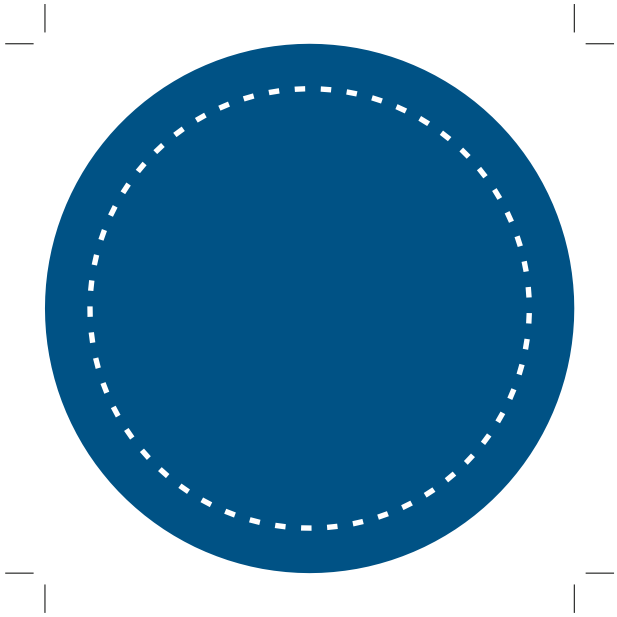
The graphical symbol within the safety sign shall not extend into the exclusion zone indicated by a dotted line as shown on the following safety sign templates (see Figures 8 to 12) except where absolutely necessary to maintain visual clarity and understanding.

7.4.2 Prohibition signs

Exclusion zone: A zone, set within the circular graphic area, which has a width equal to 0,033 of the outer diameter of the sign.
The boundary of the exclusion zone is shown by a dotted black line.

Figure 8 — Exclusion zone for prohibition signs

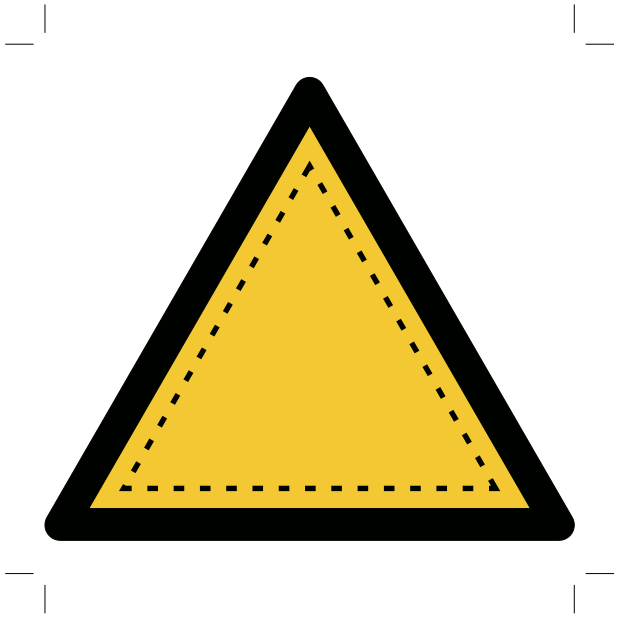
7.4.3 Mandatory action signs



Exclusion zone: A zone, set within the circle, which has a width equal to 0,08 of the outer diameter of the sign.
The boundary of the exclusion zone is shown by a dotted white line.

Figure 9 — Exclusion zone for mandatory action signs

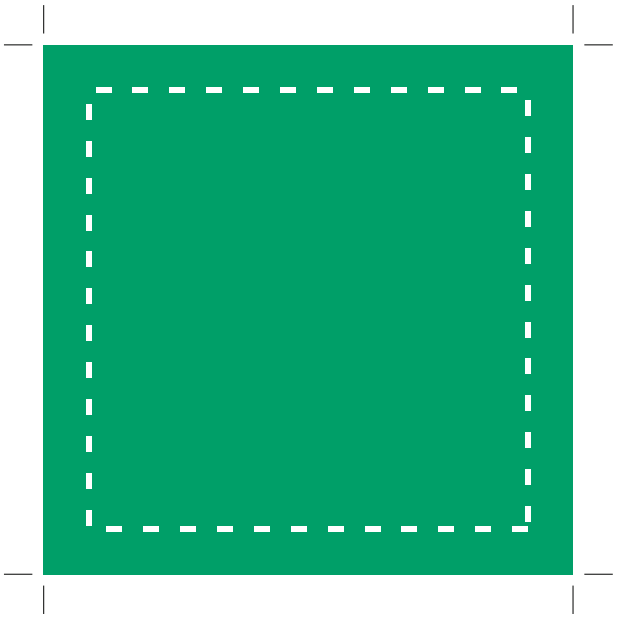
7.4.4 Warning signs



Exclusion zone: A zone, set within the triangle, which has a width equal to 0,033 of the sign height.
The boundary of the exclusion zone is shown by a dotted black line.

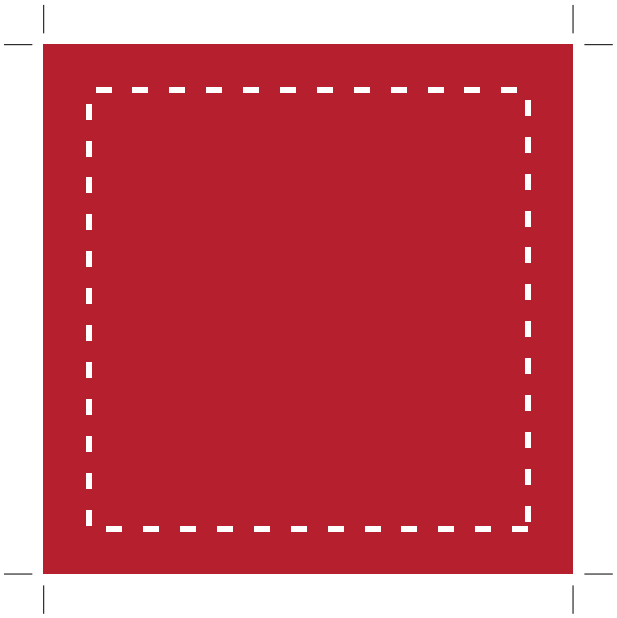
Figure 10 — Exclusion zone for warning signs

7.4.5 Safe condition signs and fire equipment signs



Exclusion zone: A zone, set within the square, which has a width equal to 0,08 of the square height. The boundary of the exclusion zone is shown by a dotted white line.

Figure 11 — Exclusion zone for safe condition signs



Exclusion zone: A zone, set within the square, which has a width equal to 0,08 of the square height. The boundary of the exclusion zone is shown by a dotted white line.

Figure 12 — Exclusion zone for fire equipment signs

7.5 Line width

Lines used in a graphical symbol shall have a minimum width of 1 mm within the relevant templates given in 7.4, except where it is absolutely necessary for lines to be thinner in order to accurately represent the object or hazard, in which case the minimum width can be reduced to 0,5 mm. See Figure 13 as an example where the line width exceeds 1 mm. See Figure 14 as an example where the minimum line width (minute hand of watch) is 0,5 mm.

The spacing between lines should take into account visual clarity.

To check the legibility of a graphical symbol, see Clause A.5.

Figure 13 — Warning; Non-ionizing radiation (ISO 7010-W005) — Original size (70 mm) and size reduction to 25 %

Figure 14 — No metallic articles or watches (ISO 7010-P008) — Original size (70 mm) and size reduction to 25 %

7.6 Consistency within a family of graphical symbols

To ensure consistency in graphical symbol design, designers shall use existing symbol elements from ISO 7010 and ISO 20712-1 wherever possible. This principle is particularly important when designing a group of safety signs that have different but related meanings.

NOTE 1 The safety sign shown in Figure 15 includes as an element the graphical representation of a human heart. For example, if a designer seeks to develop a new “heart-related” symbol for future inclusion in ISO 7010, the designer should give first consideration to using the graphical representation of a heart as shown in Figure 16 before attempting to design a new “heart” symbol element.

NOTE 2 The meaning of graphical symbols becomes clearer when the graphical symbol elements are used consistently. For example, a single head shape should be used in all safety signs that indicate wear eye protection, wear ear protection, wear head protection, wear a mask, etc. The element of the head shape, when used consistently in such safety signs, emphasizes the different graphical elements of the safety signs and draws attention to the differences in meaning of the safety signs.

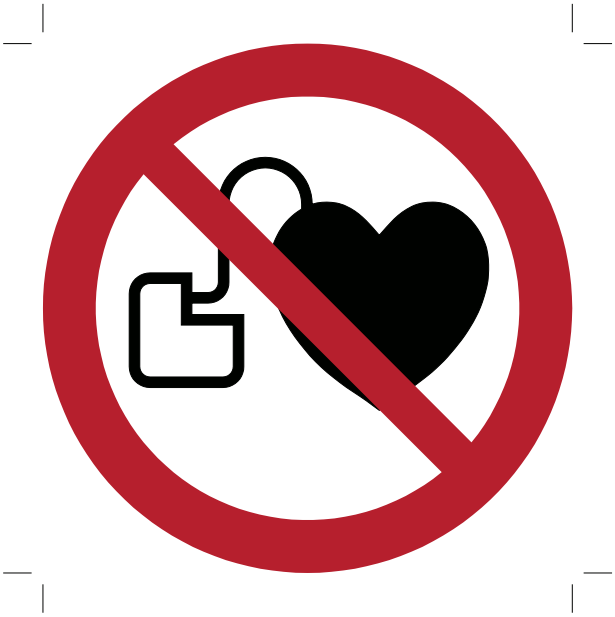


Figure 15 — No access for people with active implanted cardiac devices (ISO 7010-P007)

Figure 16 — Possible element of a graphical symbol in a safety sign related to the human heart

7.7 Determinants

The use of a common element across a family of safety signs can demonstrate a linked basic meaning and improve comprehension. Examples of such common elements are the white flames in fire equipment signs (see Figure 17) and the white cross in safe condition signs (see Figure 18).

Where determinants are used to add meaning to a family of safety signs, they shall be used without any modification.

Figure 17 — Fire hose reel (ISO 7010-F002)

Figure 18 — Eyewash station (ISO 7010-E011)

7.8 Combination of graphical symbols or graphical symbol elements

If two or more graphical symbols or graphical symbol elements are combined to form a new graphical symbol, the meaning assigned to the new graphical symbol shall be consistent with the meaning of the individual graphical symbols or graphical symbol elements used.

The new graphical symbol should consist of as few components as possible and the meaning should be unambiguous.

Safety signs in which two or more graphical symbols or graphical symbol components have been combined to produce a new graphical symbol shall be considered as new safety signs.

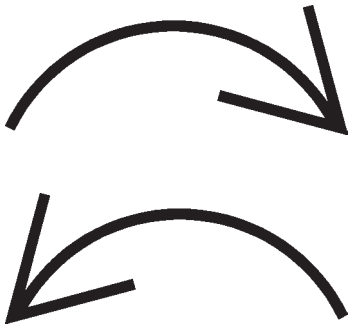
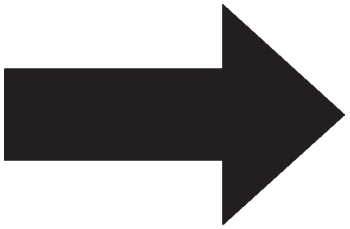
7.9 Use of arrows in graphical symbols

Arrows can be added to show actual or potential movement. Where arrows are used to depict different types of movement, forces or pressure, the form and use of the arrow shall be in accordance with Table 1.

NOTE 1 Arrow form type A can be used to indicate the direction of motion of components in the graphical symbol, or to indicate falling or flying objects.

NOTE 2 Arrow form type C can be used to indicate the flow of a fluid.

Table 1 — Form and use of arrows

Form	Representation	Nominal angle of the arrow head	Meaning
Type A		60°	Movement in one direction
Type B		60°	— Rotational movement — Clockwise rotation — Anticlockwise rotation
Type C		84°	Force or pressure
Type D		84° to 86°	Movement of people

7.10 Characters

Letters, numbers, punctuation marks and mathematical symbols shall not be used as parts of graphical symbols.

NOTE The only exception to this rule is the use of the exclamation mark in the general warning sign and in the general mandatory action sign.

Annex A
(informative)

Additional design guidelines

A.1 General

The graphical symbol should have only as much detail as is required to communicate the intended message. The graphical symbol should:

— be simple in order to facilitate comprehension and reproduction;

— be readily associated with its intended meaning;

— be based on objects, concepts, activities, etc., or a combination of these, which are familiar to the target group;

— be easily distinguishable from other graphical symbols;

— contain only those details that contribute to understanding.

When creating a graphical symbol for use in a mandatory action sign, a warning sign, a safe condition sign or a fire equipment sign, the designer should keep in mind the possibility that the same graphical symbol might need to be used in a prohibition sign to indicate a prohibited action. When a graphical symbol is used in a prohibition sign, the diagonal bar obscures a portion of the graphical symbol. Thus, if it is anticipated that the graphical symbol is likely to be used in a prohibition sign, the designer should make sure critical elements necessary for understanding the safety sign are not located in the area that is obscured by the prohibition sign's diagonal bar.

A.2 Graphical symbol image content

The image content of a graphical symbol consists of the graphical elements the symbol uses to convey the intended message. All graphical symbol elements are abstract to a greater or lesser degree, they all depict an idea, object or a meaning in an abstract manner. Yet some symbols are more easily comprehended because the image content is easily recognized and this is typically accomplished by the graphical symbol being more representational than abstract in its form. If possible, the graphical symbol's image content should be more representational in nature. This can be accomplished by designing graphical symbols that depict specific safety information. Hazards should be depicted specifically, especially when the nature or location of the hazard is not readily apparent, such as a "hidden" hazard inside a machine.

If human interaction is a part of the message, it is preferable to depict the human element in the graphical symbol. For instance, the ISO 7010 fire equipment sign for "Fire alarm call point" (see Figure A.1) has replaced the older symbol in the withdrawn ISO 6309 (see Figure A.2). The ISO 7010 graphical symbol is much easier to comprehend and it is active in its depiction (i.e. the human hand is shown approaching the alarm button).

Filled areas could improve the legibility of the graphical symbol (see Figure 2), particularly for longer viewing distances.

Outline forms could be appropriate for distinguishing and recognition of elements within graphical symbols.

For personal protection equipment (PPE) worn on the human head, the equipment should be shown as a filled image with the head in outline. For PPE worn on the body, if a human figure or torso is included in the graphical symbol, the equipment should be shown as a filled image with the human figure or torso in outline.

Figure A.1 — Fire alarm call point (ISO 7010-F005)

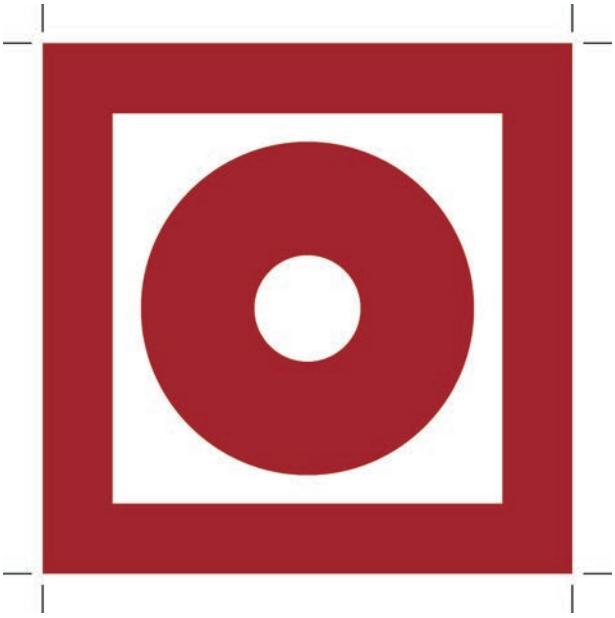


Figure A.2 — Fire alarm call point (ISO 6309, withdrawn)

A.3 Representation of the human figure and human elements

A.3.1 General

The human figure or body element is frequently the main component in a graphical symbol and should be depicted in a simple, consistent and believable form.

Interpretation should be instantaneous and not require the viewer to study the symbol to determine what part of the body is involved with the hazard. When designing safety signs that incorporate the human figure or human elements, consider the position of these elements in relation to the following:

— the nature of the hazard;

— the direction from which the hazard comes or the orientation of the hazard;

— movements or positions resulting from involvement with the hazard;

— the type of injury caused by the hazard;

— movements of positions involved in an action or in the operation of a product.

Blood should not be represented.

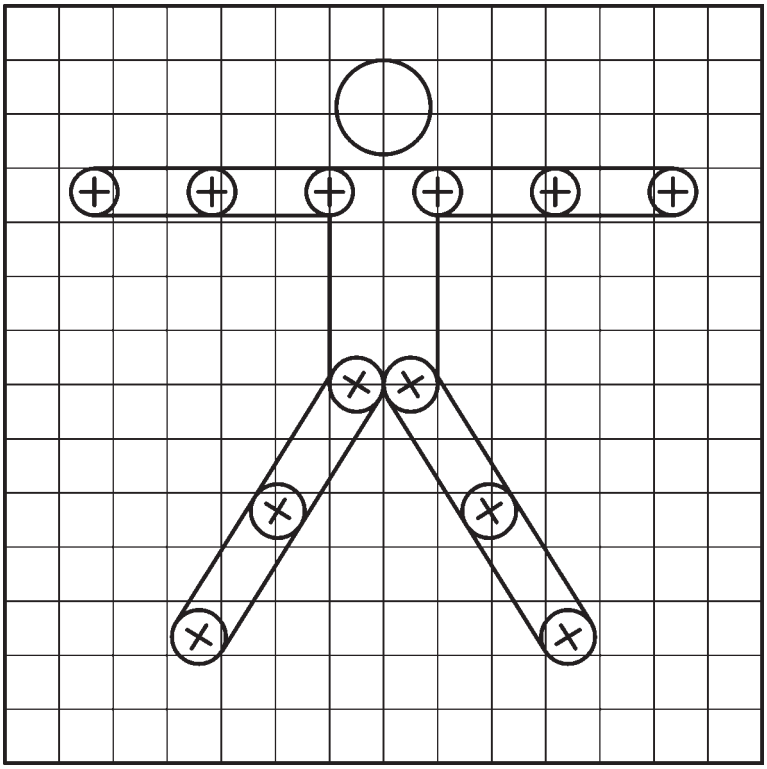
A.3.2 Drawing the human figure using the unit system

The use of the simple human figure template shown in Figures A.3, A.5 and A.6 should be considered for purposes of proportioning elements of the human figure and for depiction of different actions or movements (see Figures A.4 and A.7).

The symbol of the human figure is based on a grid system of uniform sized squares, or units. The full human figure is 12 units tall, 2 units wide at the trunk and has a circular head 1,75 units in diameter. The legs are 1 unit wide, and the arms 7/8 of a unit wide. The precise unit measurements for drawing the figure are shown in Figures A.3 and A.6. The hands and feet may end in semicircles, as shown in the template, or may be squared or slightly rounded and slanted. The pivot points are shown for elbow, shoulder, hip and knee joints. Connection points for hands and feet are also shown at the end of the limbs. The pivot and connection points are provided in the template to assist the designer to manipulate the figure into a position consistent with the desired posture and for the option of adding feet and/or hands to the full body illustration (see Figures A.10 and A.16).

A.3.3 Human figure animation

By using pivot points (see Figures A.3 and A.6), action or movement of the figure can be depicted. The unit proportions remain the same, except in situations where the overlapping of limbs causes a visual foreshortening of the limbs. When foreshortening occurs, it is compensated for by adding 0,5 of a unit to the limb (see Figure A.4).



⊕ = pivot point

Figure A.3 — Full human body design template for animation

Figure A.4 — Examples of how the human figure can be animated using pivot points

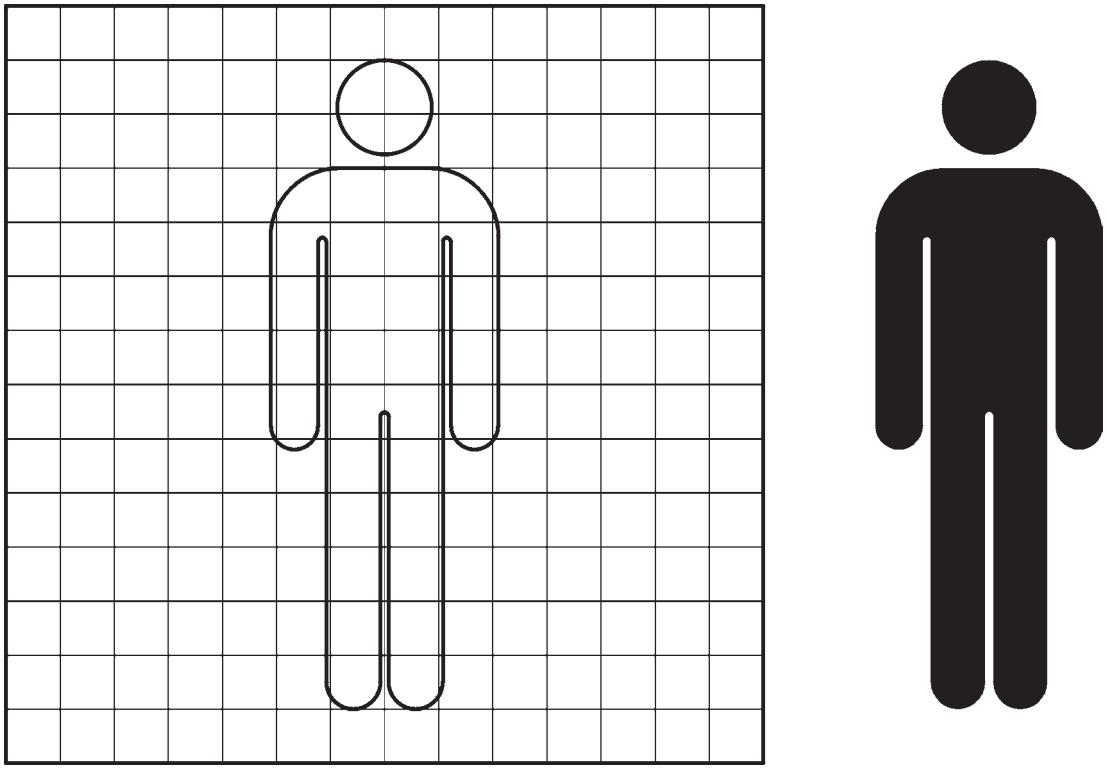
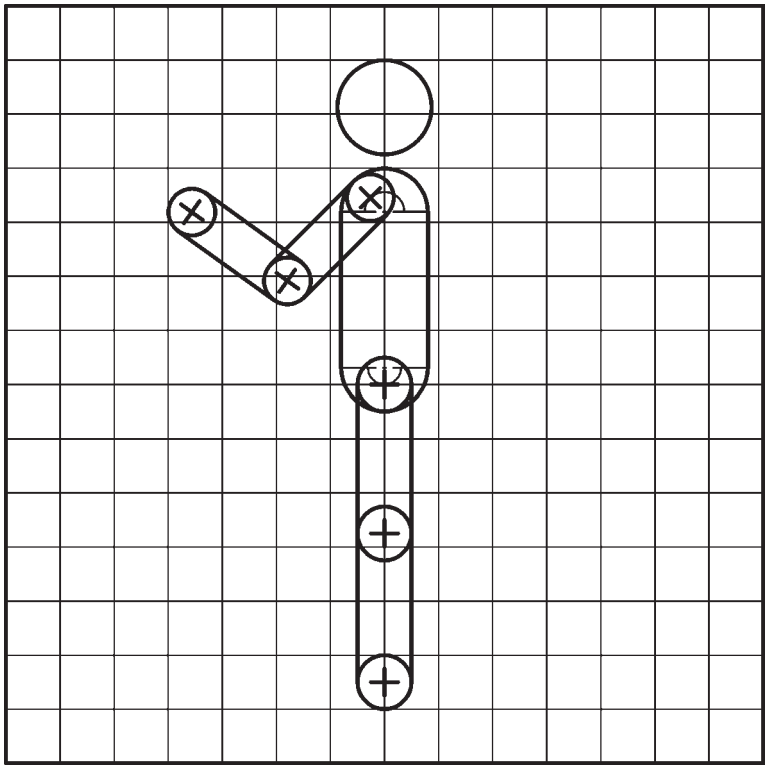


Figure A.5 — Full human body design template, standing, front view



⊕ = pivot point

Figure A.6 — Full human body design template for animation, profile view

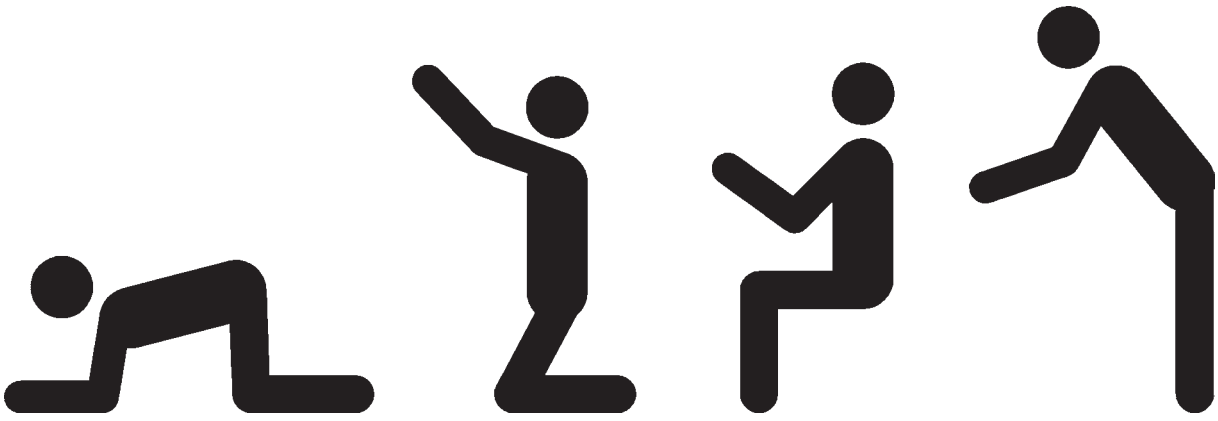


Figure A.7 — Examples of how the human figure can be animated using pivot points, profile view

A.3.4 Drawing the human head

The health of the working population can be endangered by hazards to the head. Such hazards can arise in various ways. Therefore, the human head and face is a necessary part of a number of safety signs, especially mandatory action signs indicating the use of PPE.

For all safety signs needing a head as part of the graphical symbol, one type of head should be used. The global versions of the outlined head that is to be used for safety signs should not, in order to be widely accepted in an ethnically diversified world, carry any ethnic specifics.

Figures A.8 and A.9 show the two versions (profile view and front view) of the outlined head that should be used to create graphical symbols for use in safety signs indicating a head-related hazard. The profile view should be preferred.

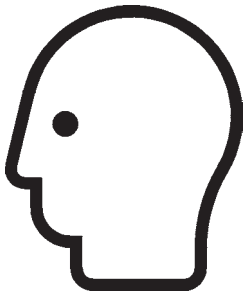


Figure A.8 — Profile of human head

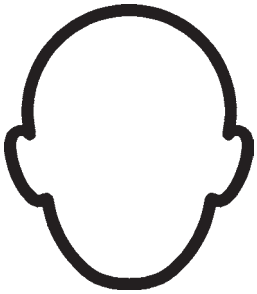
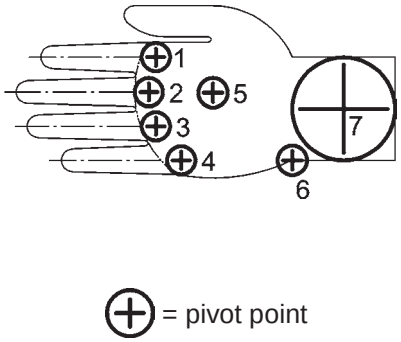


Figure A.9 — Front view of human head

A.3.5 Drawing the human hand and fingers

The complexity of the human hand and the many possible finger movements make hands one of the most difficult symbol elements to depict. A simplified shape and form for depicting the human hand and fingers is presented in Figure A.10. In the full palm view, the fingers and thumb should not be moved to other positions (i.e. they should not be spread). In other full hand views, fingers may be spread.



Key

1	pivot point for index finger	5	pivot point for thumb
2	pivot point for middle finger	6	pivot point for hand
3	pivot point for ring finger	7	pivot/connection point for hand
4	pivot point for small finger		

Figure A.10 — Hand

A.3.6 Human hand profiles

When hazards involve the hands or arms, hands should be added to the figure to increase recognition of the limb elements. Basic hand positions are shown in Figure A.11.

The selection of a position should be based on which position is judged to best dramatize the involvement with the hazard. For design consistency, hands should be added to both arms (when both arms are shown), even when only one arm is involved with the hazard.

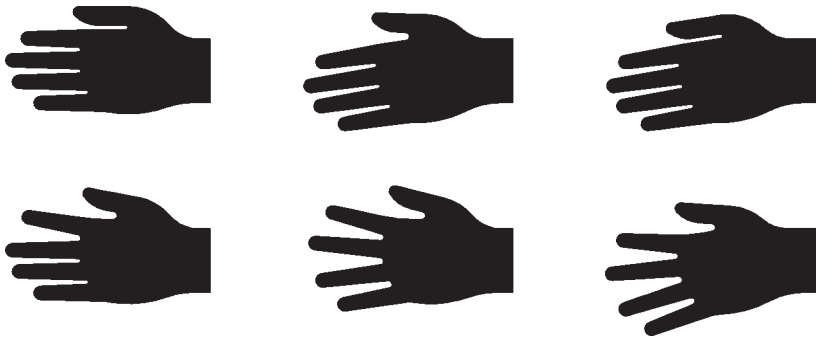


Figure A.11 — Hand positions

To convey a feeling of depth, hand profiles should be used.

NOTE 1 When the hand is shown in perspective, the positioning of the fingers can create a three-dimensional impression.

The basic hand profile may be modified to best depict the interaction of the hand and fingers with different types of equipment. Examples of such interaction include:

— fingers caught in rollers (see Figure A.12);

— hand and fingers struck by a sharp object (see Figure A.13);

— fingers caught between gears (see Figure A.14);

— fingers touching a surface (see Figure A.15).

NOTE 2 The fingers are not tapered and the finger tips are rounded. The profile view uses only three fingers plus the thumb.

Figure A.12 — Example 1 for hand profile

Figure A.13 — Example 2 for hand profile

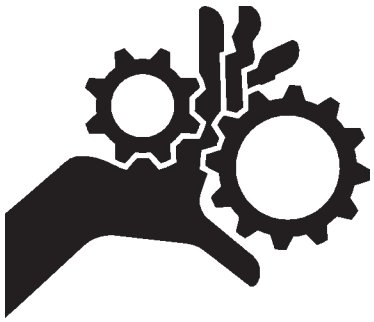
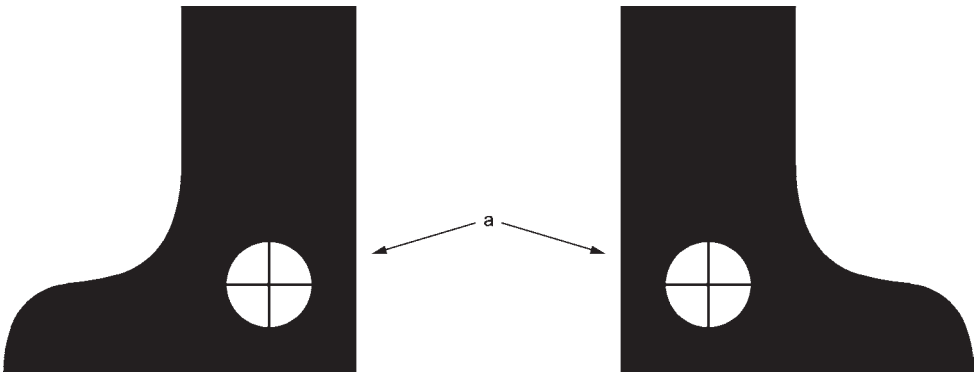


Figure A.14 — Example 3 for hand profile

Figure A.15 — Example 4 for hand profile

A.3.7 Drawing the human foot

To depict just the lower leg or foot, the stylized foot shown in Figure A.16 may be used. It can be used facing either left or right. For depiction of some hazards which involve the feet or lower limbs, depiction of the full human figure with feet added can increase recognition of the limb element that is involved with the hazard (see Figure A.17). For such graphical symbols, the feet shown in Figure A.16 may be added to the leg end connection points of the human figure template shown in Figures A.3 and A.6.



a) A position **b) B position**

[a] Foot connection points.

Figure A.16 — Stylized foot with connection points

Figure A.17 — Example of dynamic depiction of a hazard using the human body template with stylized feet

A.4 Representation of water in water safety signs

Water is one of the main elements of many graphical symbols used in water safety signs. Where depicting views of activities or equipment on or above the surface of the water, the water should be represented by two wavy lines. Where depicting views of activities or equipment below the surface of the water, the water should be represented by a single wavy line. Where depicting the depth of the water, the water should be represented by multiple wavy lines. The representation of water should be consistent with the family of graphical symbol elements given in ISO 20712-1.

A.5 Perceptual quality

To check the legibility of a new graphical symbol, the designer can use the test methods of ISO 9186-2 to evaluate the size and shape of the graphical elements for their identifiability and to determine the factor of distance for application of the safety sign as given in ISO 3864-1:2011, Annex A. Initial checking of the legibility of details at the design stage can involve viewing the template size reduced to 25 %, see Figures 13 and 14.

A.6 Comprehensibility

To check the comprehensibility of a safety sign, the designer should use the test methods of ISO 9186-1 to evaluate how well the safety sign communicates its intended meaning. The safety sign original should then be modified, if necessary.

Where the normal size of application of the safety sign is less than 70 mm, the safety sign should be tested at the intended size of application.

Bibliography

[1] ISO 7000, *Graphical symbols for use on equipment — Registered symbols* [1) 2)]

[2] ISO 7001, *Graphical symbols — Public information symbols* [2)]

[3] ISO 9186-1, *Graphical symbols — Test methods — Part 1: Methods for testing comprehensibility*

[4] ISO 9186-2, *Graphical symbols — Test methods — Part 2: Method for testing perceptual quality*

[5] ISO/IEC Guide 74, *Graphical symbols — Technical guidelines for the consideration of consumers' needs*

1) The database *Graphical symbols for use on equipment*, accessible at the electronic address http://www.graphical-symbols.info/, contains the collection of the graphical symbols from IEC 60417 and ISO 7000.

2) The graphical symbol collections of ISO 7000, ISO 7001 and ISO 7010 are also available on line in the ISO web store. For more information, consult http://www.iso.org/iso/publications_and_e-products/databases.htm.

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