

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Basic principles for graphical symbols for use on equipment –
Part 1: Creation of graphical symbols for registration**

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**Principes de base pour les symboles graphiques utilisables sur le matériel –
Partie 1: Création des symboles graphiques pour enregistrement**

IEC 80416-1:2008
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**BASIC PRINCIPLES FOR GRAPHICAL
SYMBOLS FOR USE ON EQUIPMENT –****Part 1: Creation of graphical symbols for registration**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 80416-1 has been prepared by IEC subcommittee 3C: Graphical symbols for use on equipment, of IEC technical committee 3: Information structures, documentation and graphical symbols.

This International Standard has been prepared in co-operation with ISO/TC145/SC 3.

It is published as a double logo standard.

This second edition cancels and replaces the first edition published in 2001. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) Clause 8 in the previous edition is moved to Clause 4;

- b) Mandatory requirement for the line width in symbol originals is changed to 2 mm or 4 mm (see 6th paragraph of 7.3);
- c) For negation of a graphical symbol, a single diagonal bar is allowed in addition to two diagonal bars at right angles;
- d) A new meaning of negation “do not” is allowed;
- e) Some freedom is given for use of the basic pattern such as for symbol originals to be within the 75 mm square instead of the octagon;
- f) Annex A (normative) is newly introduced for provisions on title, description and notes;
- g) The nature of notes is changed to be purely informative; and
- h) Clause 10 in the previous edition is moved to Annex C (informative).

It has the status of a horizontal standard in accordance with IEC Guide 108.

The text of this standard is based on the following documents:

FDIS	Report on voting
3C/1590/FDIS	3C/1609/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table. In ISO, the standard has been approved by 7 P members out of 7 having cast a vote.

STANDARD PREVIEW
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This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

In order to collect all requirements concerning relevant basic principles within one single numerical series, ISO technical committee 145: Graphical symbols and IEC technical committee 3 agreed to publish all parts of this International Standard within the 80416 series. The Technical Management Board of ISO and the Standardization Management Board of IEC have decided that, for each part of this series, one organisation shall be chosen responsible. The technical committees involved have agreed not to change any part of International Standard 80416 without mutual agreement.

International Standard 80416 consists of the following parts, published under the general title *Basic principles for graphical symbols for use on equipment*:

- Part 1: 2008, Creation of graphical symbols for registration (*published by IEC*)
- Part 2: 2001, Form and use of arrows (*published by ISO*)
- Part 3: 2002, Guidelines for the application of graphical symbols (*published by IEC*)
- Part 4: 2005, Guidelines for the adaptation of graphical symbols for use on screen and displays (icons) (*published by ISO*)

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

A graphical symbol is defined as a visually perceptible figure with a particular meaning used to transmit information independently of language. Graphical symbols are used on equipment for a wide range of purposes. The understanding of such symbols can be improved by consistent design. This is particularly important where families of symbols are used in one location or on similar equipment. Good design also helps to maintain the legibility of symbols when they are reduced to small dimensions for application. Thus, there is a need to standardize the principles for creating graphical symbols for use on equipment to ensure visual clarity, to maintain consistency and thereby to improve recognition.

International Standard 80416 is a multi-part standard which provides basic principles and guidelines for the creation of graphical symbols for use on equipment (Parts 1 and 2) and also principles and guidelines for adapting registered graphical symbols for use in practice (Parts 3 and 4).

This part of the multi-part standard addresses the basic rules used to create graphical symbols for use on equipment, including line widths, negation elements, and the use of the basic pattern. These design principles should be applied to all graphical symbols for use on equipment. They are required for graphical symbols for registration in IEC 60417 and ISO 7000.

It is recommended that symbol originals intended for specific fields of application are also published in the appropriate technical product standard.

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BASIC PRINCIPLES FOR GRAPHICAL SYMBOLS FOR USE ON EQUIPMENT –

Part 1: Creation of graphical symbols for registration

1 Scope

This part of IEC 80416 provides basic principles and guidelines for the creation of graphical symbols for registration, and provides the key principles and rules for the preparation of title, description and note(s).

IEC 80416-1 applies to graphical symbols used:

- to identify the equipment or a part of the equipment (for example, controls or displays);
- to indicate functional states or functions (for example, on, off, alarm);
- to designate connections (for example, terminals, filling points);
- to provide information on packaging (for example, identification of content, instructions for handling);
- to provide instructions for the operation of the equipment (for example, limitations of use).

IEC 80416-1 does not apply to graphical symbols for:

- safety signs;
- use on drawings and diagrams;
- use in technical documentation of products and in technical product documentation;
- use for public information.

This horizontal standard is primarily intended for use by technical committees in the preparation of standards in accordance with the principles laid down in IEC Guide 108.

One of the responsibilities of a technical committee is, wherever applicable, to make use of horizontal standards in the preparation of its publications. The contents of this horizontal standard will not apply unless specifically referred to or included in the relevant publications.

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.

IEC 60417, *Graphical symbols for use on equipment*

ISO/IEC Guide 71, *Guidelines for standards developers to address the needs of older persons and persons with disabilities*

ISO/IEC Guide 74, *Graphical symbols – Technical guidelines for the consideration of consumers' needs*

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

ISO 80416-2, *Basic principles for graphical symbols for use on equipment – Part 2: Form and use of arrows*

3 Terms and definitions

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

3.1

basic line width

line width used to draw the most significant part of a symbol original; 2 mm or 4 mm

3.2

description

normative text which defines the purpose, the application and the use of the graphical symbol, and optional product area

3.3

equipment

associated assemblies intended to achieve a defined final objective

3.4

graphical symbol

visually perceptible figure with a particular meaning used to transmit information independently of language

3.5

graphical symbol element

part of a graphical symbol which is used with a particular meaning in more than one graphical symbol

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NOTE 1 Letters, numerals, punctuation marks and mathematical symbols may be used as graphical symbol elements (see ISO 31 and IEC 60027).

NOTE 2 A graphical symbol element with a specific meaning may be used to provide a common concept in the construction of a symbol family.

3.6

graphical symbol for registration

draft symbol original including the basic pattern, title, description and optional notes

3.7

nominal size

50 mm; the lateral dimension of the basic square 2 as shown in the basic pattern

3.8

symbol original

drawing of a graphical symbol, including the corner markings, prepared in accordance with IEC 80416-1 and, where appropriate, ISO 80416-2, and registered in IEC 60417 or ISO 7000

3.9

title

unique name by which a graphical symbol is identified and spoken of

NOTE The title should be as short as possible; it is only intended to provide a unique name for the graphical symbol and, where appropriate, another name(s), but not to describe its application.

4 Creation procedures

A designer considering the creation of a graphical symbol should become familiar with the context of use of the intended symbol and then follow the following steps:

- a) define clearly the purpose and meaning of the graphical symbol – i.e. will it be used to identify equipment, indicate a functional state, designate a connection, provide information on packaging, provide instructions on the operation of equipment, or a combination of these;
- b) identify the users of the graphical symbol (see ISO/IEC Guide 74) and any special needs (see ISO/IEC Guide 71) and legal requirements;
- c) ascertain whether an existing graphical symbol will fulfil the specifications and requirements by checking IEC 60417 and ISO 7000;
- d) where it is clear that a suitable graphical symbol does not exist, design a new graphical symbol in accordance with the provisions of Clause 7 and Clause 8, and, where appropriate:
 - 1) identify any cultural and ethnic sensibilities and prohibitions that are relevant and take them into account;
 - 2) consider the effect on legibility of adding a negation cross or diagonal bar and make any necessary adjustments to the design;
 - 3) take into account the relationship with any other symbols, symbol elements and symbol families and the related visual concept;
 - 4) ensure that the design does not lend itself to an unintended or ambiguous meaning.
- e) undertake an assessment of the legibility, perceptual quality, and comprehensibility of the newly designed graphical symbol and adjust the design if the results are not satisfactory;
- f) create a unique title for the graphical symbol; and
- g) create a clear and unambiguous description of the graphical symbol and any operational requirements (the latter will be included in the description).

Requirements for title, description and notes are given in Annex A.

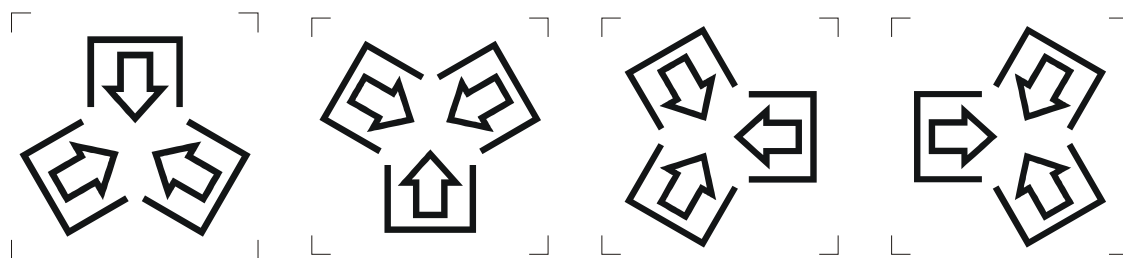
5 Meaning

5.1 Assignment

The meaning assigned to each registered graphical symbol is the result of associating a title, a symbol original and a description. The assigned meaning should be unambiguous and clear.

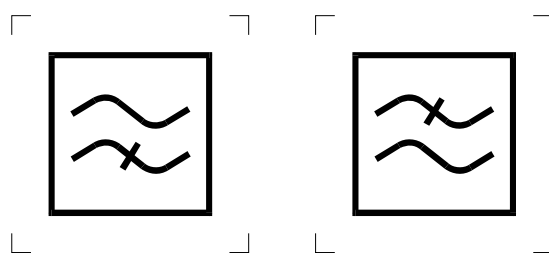
5.2 Orientation of the graphical symbols

Graphical symbols should normally be used in the orientation specified by the symbol originals. Care should be taken to avoid ambiguity in the case of a graphical symbol where its meaning depends on the orientation. Such ambiguity could occur, for instance, when graphical symbols are placed on rotary knobs. Symbol originals should whenever possible be created so as to preserve their meaning in any orientation as the example a) in Figure 1. However, when the meaning of a graphical symbol does depend on its orientation, as in the case of the examples b) in Figure 1, this shall be explicitly stated in the description of the symbol original.



ISO 7000-0414: Cores in moulding position

a) Example of a graphical symbol the meaning of which is independent of its orientation

IEC 60417-5091:
High-pass filterIEC 60417-5092:
Low-pass filter

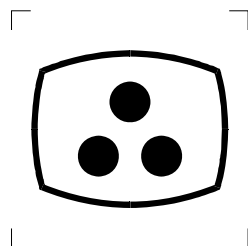
b) Examples of graphical symbols the meaning of which depends upon their orientation

Figure 1 – Graphical symbols in different orientation

NOTE Designation systems for symbol originals in IEC 60417 and ISO 7000 are given in Annex C.

6 Combination of graphical symbols

To represent certain concepts, graphical symbols or graphical symbol elements may be combined to form a new symbol original. The meaning assigned to the new graphical symbol shall be consistent with the meanings of the individual graphical symbols or graphical symbol elements. See the example shown in Figure 2.



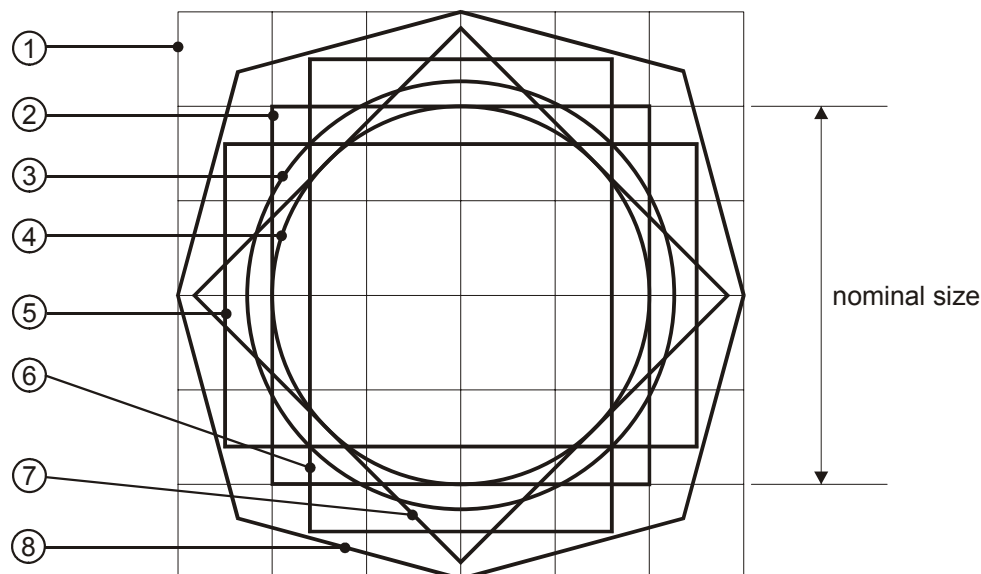
IEC 60417-5050: Colour television

Figure 2 – Example of combination of graphical symbols
(IEC 60417-5049: “Television” combined with IEC 60417-5048: “Colour” to give
IEC 60417-5050: “Colour television”)

7 Creation principles

7.1 Creation of symbol original

A symbol original shall be created within the basic pattern shown in Figure 3, taking into account the requirements given in Clause 8. These guidelines and requirements apply equally to graphical symbols submitted for registration to IEC 60417 and ISO 7000.



Reference	Description
1	Square of 75 mm lateral length, forming the largest horizontal and vertical dimensions of the basic pattern and divided into a grid of 12,5 mm line spacing.
2	Basic square of 50 mm lateral length. This dimension is equal to the nominal size, 50 mm, of the symbol original.
3	Basic circle of 56,6 mm diameter, having approximately the same surface area as the basic square 2.
4	Circle of 50 mm diameter, being the inscribed circle of the basic square 2.
5, 6	Two rectangles having the same surface area as the basic square 2, a width of 40 mm and a height of 62,5 mm. They are mutually perpendicular, each drawn to cross symmetrically opposite sides of the basic square 2.
7	Basic square 2 of 50 mm rotated by 45°.
8	Octagon formed by lines at 15° to the outer sides of grid 1.

NOTE The basic pattern as templates for drawing software can be downloaded from the IEC web site (<http://sc3c.iec.ch>) and the ISO web site (<http://www.iso.ch/tc145/sc3>).

Figure 3 – Basic pattern

7.2 Design guidelines

The design of a symbol original should be:

- a) simple, in order to facilitate perception and reproduction;
- b) readily distinguishable from those of other graphical symbols with which it may be used;
- c) easily associated with its intended meaning, that is either self-evident or easily learned;
- d) such that it can be produced by usual manufacturing and reproduction methods.

NOTE 1 Particular attention should be given to avoiding unnecessary detail and complexity in the creation of the graphical symbol to prevent poor legibility where the intended size of reproduction of the graphical symbol is small, for example on a small key cap, or the viewing distance is large.

NOTE 2 In practice, to improve the appearance and perceptibility of a symbol original in use, or to coordinate with the design of the equipment to which it is to be applied, it may be necessary to modify symbol originals in accordance with IEC 80416-3 and ISO 80416-4.

7.3 Line width

A symbol original shall be drawn using the basic line width, 2 mm or 4 mm.

Reasons for choosing 2 mm include the existence of related graphical symbols which are already registered or design complexity which makes it impossible to draw the symbol in 4 mm.

Reasons for choosing 4 mm include the existence of related graphical symbols which are already registered or the avoidance of unnecessary detail and complexity in order to achieve a simple design for easier recognition.

A combination of both line widths may be used to emphasize parts of the graphical symbol or to increase visual clarity. An example is shown in Figure 4.

If graphically necessary, parts of the symbol original may be drawn using other line widths greater than 2 mm, e.g. for depicting shapes.

In exceptional cases, a symbol original may be drawn using line widths other than the basic line width to be consistent with already standardized graphical symbols in ISO 7000 or IEC 60417 which are covered by technical regulations.

Versions of the same graphical symbol using a 2 mm and a 4 mm basic line width may be registered.

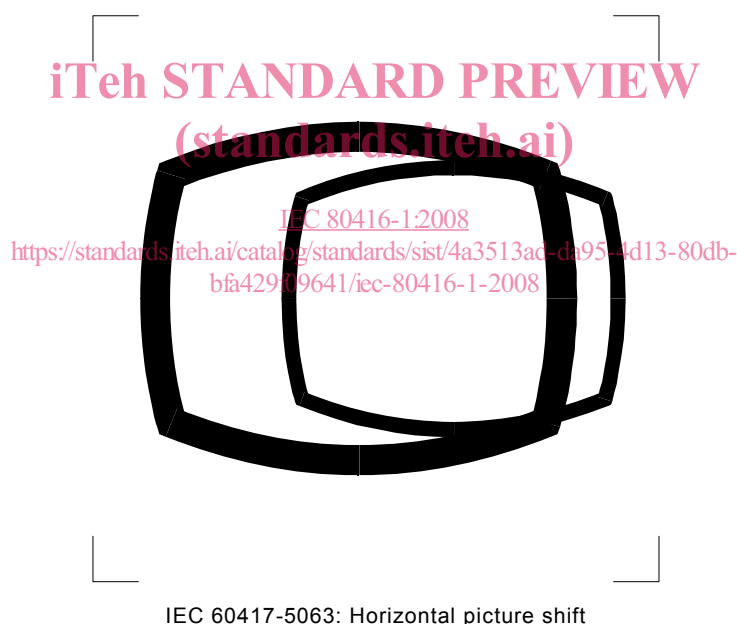


Figure 4 – Examples of the use of line width

7.4 Spacing

The minimum spacing between lines of a symbol original shall be chosen to take into account visual clarity and the reproduction methods to be used. The minimum space between parallel lines shall be 3 mm.

7.5 Angles

Angles smaller than 30° in a symbol original should be avoided.

7.6 Filled areas

Filled areas in a symbol original should be avoided except when the meaning or legibility of the symbol original requires that an area is filled.

7.7 Symbol original with arrows

For a symbol original which incorporates arrows, the principles in ISO 80416-2 shall apply.

7.8 Characters as symbol elements

For constituent elements of symbol originals such as letters, numbers, punctuation marks and mathematical symbols, a simple character form should be used. The minimum character height in the symbol original should be 10 mm.

NOTE The font shown in a symbol original is not restrictive; other fonts may be used provided legibility is maintained.

7.9 Negation

7.9.1 Methods of negation

Negation shall be indicated by a cross of lines formed by two diagonal bars at right angles, as in the examples a) and c) in Figure 5. In exceptional cases, only for visual clarity, a single diagonal bar as in the example b) in Figure 5 may be used.

NOTE The standardization of the negated symbol original is only necessary if the negated version represents a specific meaning.



Figure 5 – Examples of negation

7.9.2 Angle of negation

For purposes of visual clarity only, the angle at which the diagonal bars meet to form the negation cross may deviate from 90° and the angle of the single diagonal negation bar may deviate from 45°.

7.9.3 Meaning of negation

The negation symbol elements can be used to indicate the non-availability of a function due to cancellation by the user or for operational reasons, as shown in examples a) and b) of Figure 5. The negation symbol elements may also be used to indicate required behaviour (such as “do not”) as in example c) of Figure 5.

7.9.4 Negation as prohibition

A circle combined with a diagonal bar is defined in ISO 3864-1 for use in safety applications to denote a ‘prohibition’. Therefore, a circle combined with a diagonal bar, in any colour including black and white, shall not be used for the negation of graphical symbols for use on equipment.

8 Basic pattern

8.1 Structure

The basic pattern shown in Figure 3 shall be used as the basis for the creation of a symbol original (see 8.2). It is used as a tool for the design of a symbol original to ensure a balanced visual impression among the graphical symbols.

8.2 Application of the basic pattern

A symbol original should fit into the basic pattern according to the following principles:

- for a symbol original consisting of a single geometrical form, such as a circle, a square or a rectangle, the corresponding geometrical forms of the basic pattern described in Figure 3 should be used;
- for other symbol originals, care should be taken to ensure that the symbol originals have the same visual impression and uniformity and are consistent with related symbols in IEC 60417 and ISO 7000;
- the key element in the basic pattern, with regard to the nominal size, is the 50 mm basic square 2. The basic circle 3 and the rectangles 5 and 6 have the same surface area. Circles without external parts should therefore be drawn on the basic circle 3, and rectangles should be drawn on the rectangles 5 and 6, in order to achieve the same visual impression of size as the basic square 2 of 50 mm. Circles with external graphical symbol elements should be drawn on the circle 4;
- symbol originals should be created to the largest size possible, in line with the above principles, and should not exceed the octagon 8 by more than half of the line width. In exceptional cases necessitated by a combination of symbol elements, the symbol original may further extend beyond the octagon 8. Symbol originals shall not extend beyond the 75 mm square 1 of the basic pattern;
- insofar as it is practicable, the lines of the symbol original should be centred on the lines of the basic pattern. However, the outer border of the lines shall not exceed the 75 mm square 1 as shown in Figure 6.

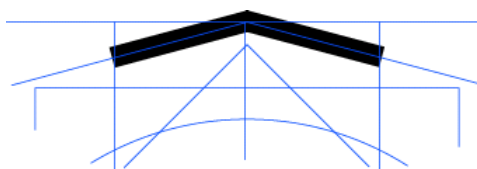


Figure 6 – Example of non-permitted line beyond the basic pattern