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INTERNATIONAL ELECTROTECHNICAL COMMISSION

Title:	**Draft 5CD for 80416-1: Basic principles for graphical symbols for use on equipment – Part 1: Creation of graphical symbols, revision 1.6**
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This document is a worked result in ISO/IEC JWG 11 meeting in Vienna, based on the document JWG N15C+, submitted comments and discussions took place. This document supersedes JWG 11 N15C+.

All examples with the basic pattern will be replaced by the symbol originals overlayed on the revised basic pattern shown in figure 4. Better examples for figure 5 will be received from a member, Mrs. Annette Schwuchow, by the 1st of April 1999 in a vector format importable to MS-Word.

Finalized version of this document will be submitted to the parent committees for consideration of circulation as Final Committee Draft for voting; DIS in ISO and CDV in IEC.

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BASIC PRINCIPLES FOR GRAPHICAL SYMBOLS FOR USE ON EQUIPMENT –

Part 1: Creation of graphical symbols

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical reports or guides and they are accepted by the National Committees in that sense.
4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 80416-1 has been prepared by IEC subcommittee 3C: Graphical symbols for use on equipment, of IEC technical committee 3: Documentation and graphical symbols.

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

FDIS	Report on voting
3C/XX/FDIS	3C/XX/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 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 Committee of Action 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.

The Annex A is informative and for information only.

Introduction

A graphical symbol is a visually perceptible figure used to transmit information independently of language. Graphical symbols are used on equipment for a wide range of purposes. For such symbols, consistency in the design of families of symbols used in one location or on similar equipment is an important issue, as is legibility when these symbols are reduced to small dimensions. 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. This multi-part standard addresses the basic rules used to create graphical symbols for use on equipment, including line widths, form and use of arrows, negation elements, and use of the basic pattern which serves as a guideline for drawing equipment symbols. These design principles are required to be used for all graphical symbols for use on equipment: the standardized graphical symbols of which are found in ISO 7000 and IEC 60417.

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

Part 1: 199x, Creation of graphical symbols (*published by IEC*)

Part 2: 199x, Form and use of arrows (*published by ISO*)

Part 3: 200x, Guidelines for the application of graphical symbols (*published by ???*)

Part 4: 200x, Supplementary principles for use of graphical symbols on screen and displays (icons) (*published by ???*)

IEC 80416-1 replaces ISO 3461-1 and IEC 60416. It provides guidelines which are equally applicable to graphical symbols prepared within ISO and IEC.

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BASIC PRINCIPLES FOR GRAPHICAL SYMBOLS FOR USE ON EQUIPMENT –

Part 1: Creation of graphical symbols

1 Scope

International Standard 80416 series provides principles and guidelines for the creation and application of graphical symbols for use on equipment.

This part of the standard specifies the basis for the creation of graphical symbols for use on equipment. In accordance with their intended meaning of the graphical symbols, it contains rules for design such as shape and size, and also for preparation of the accompanying texts.

This standard applies to graphical symbols used:

- to identify the equipment or a part of the equipment (for example, a control or display);
- 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).

This part of the standard does not apply to graphical symbols for:

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

2 Normative reference

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard 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 IEC and ISO maintain registers of currently valid International Standards.

ISO 80416-2: 199x[1)], Basic principles for graphical symbols for use on equipment – Part 2: Form and use of arrows.

ISO 3864: 1984, Safety colours and safety signs.

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1) Under development.

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

IEC 60417-1, Graphical symbols for use on equipment – Part 1: Overview and application.

IEC 60417-2, Graphical symbols for use on equipment – Part 2: Symbol originals.

3 Definitions

For the purpose of this International Standard, the following definitions apply.

3.1
graphical symbol
visually perceptible figure with a particular meaning used to transmit information independently of language. It may be produced by drawing, printing or other means.

3.2
graphical symbol element
part of a graphical symbol with a particular meaning.

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.

3.3
symbol original
drawing of a graphical symbol, prepared in accordance with this standard, used for reference or reproduction purposes.

3.4
apparent size
visual impression of size of a graphical symbol.

3.5
basic pattern
basis for creation of a symbol original to be used as a tool for the design of a graphical symbol to ensure a balanced apparent size. See also 7.1 and 7.2.

3.6
corner marking
part of a symbol original, four of which define the frame of the symbol original. See figure 6.

3.7
title
unique name by which a graphical symbol is identified and spoken of.

NOTE – The title should be as concise as possible; it is only intended to “name” the graphical symbol, and not to describe its application.

3.8
description
normative text attached to the graphical representation of the graphical symbol which defines the purpose, the application and the use of the graphical symbol.

4 Meaning

4.1 Assignment

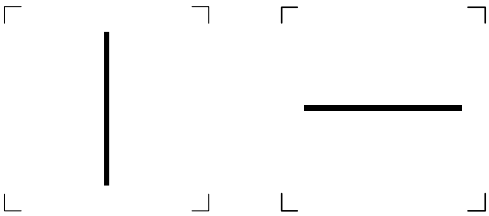
The meaning assigned to each graphical symbol is the result of associating a title, a graphical representation and a description of the application. The assigned meaning should be unambiguous and independent of terms related to a special technique or discipline.

4.2 Orientation of graphical symbols

Graphical symbols should normally be used in the orientation shown in the International Standard. Care should be taken to avoid ambiguity during design and subsequent use of graphical symbols whose meaning is dependent on their orientation. Such ambiguity could occur, for instance, when graphical symbols are placed on rotary knobs. Graphical symbols should preserve their meaning in any orientation as in the example a) of figure 1. However, when the meaning of a graphical symbol does depend on its orientation, this shall be explicitly stated as in the example b) in figure 1.

ISO 7000-0414: Cores in moulding position

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



IEC 60417-5007
"ON" (power)

IEC 60417-5006
Minus; negative polarity

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

Figure 1 – Graphical symbols in different orientation.

5 Combination of graphical symbols

To represent certain concepts, graphical symbols or graphical symbol elements may be combined to form a new graphical symbol. The meaning assigned to the new graphical symbol shall be consistent with the meanings of the individual graphical symbols or graphical symbol element used as shown in figure 2.

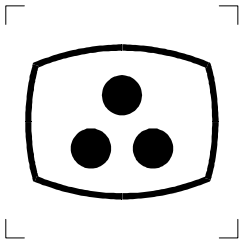


Figure 2 – Example of combination of graphical symbols (IEC 60417-5049 “television” plus IEC 60417-5048 “colour” to give IEC 60417-5050 “colour television”).

6 Creation principles

6.1 Symbol original

A symbol original shall be created within the basic pattern shown in figure 4 taking into account specifications in 7 and 8.

6.2 Design guidelines

The design of a graphical symbol shall be

a) simple, in order to facilitate perception and reproduction;

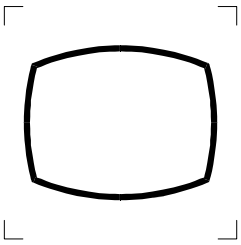
b) readily distinguishable from those of other graphical symbols with which it may be used;

c) easily associated with its intended meaning, that is either self-evident or easily learned;

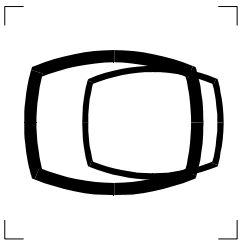
d) such that it can be produced by usual manufacturing and reproduction methods.

6.3 Line thickness

The line thickness of a symbol original shall be 2 mm as in example a) of figure 3. As an exception, for the purpose of visual clarity only, a line thickness of 4 mm may be used in combination with the 2 mm as in example b) of figure 3.



a) Television; video IEC 60417-5049



b) Horizontal picture shift IEC 60417-5063

Figure 3 – Examples of the use of line-thicknesses.

6.4 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. As a guide, the minimum space between parallel lines should not be less than 1,5 times the line thickness.

6.5 Angles

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

6.6 Filled areas

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

6.7 Symbol original with arrows

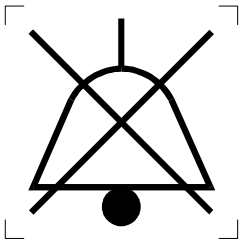
For a symbol original which incorporates arrows, the principles in ISO 80416-2 shall apply.

6.8 Character symbols

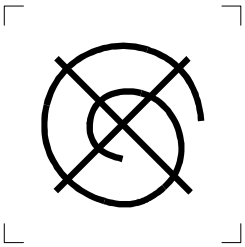
For constituent elements of symbol originals such as letters, numbers, punctuation marks and mathematical symbols, a simple character form should be used. The minimum character height in the symbol original should be 10 mm.

6.9 Negation

Negation shall be indicated by a cross of line thickness 2 mm formed by two diagonal bars at right angles, as in the example of figure 4. As an exception, for purpose of visual clarity only, the angle of the diagonal bars may deviate from 90°.



IEC 60417-5576, Bell cancel



b) IEC 60417-5231, Without spinning.

Figure 4 – Examples of negation.

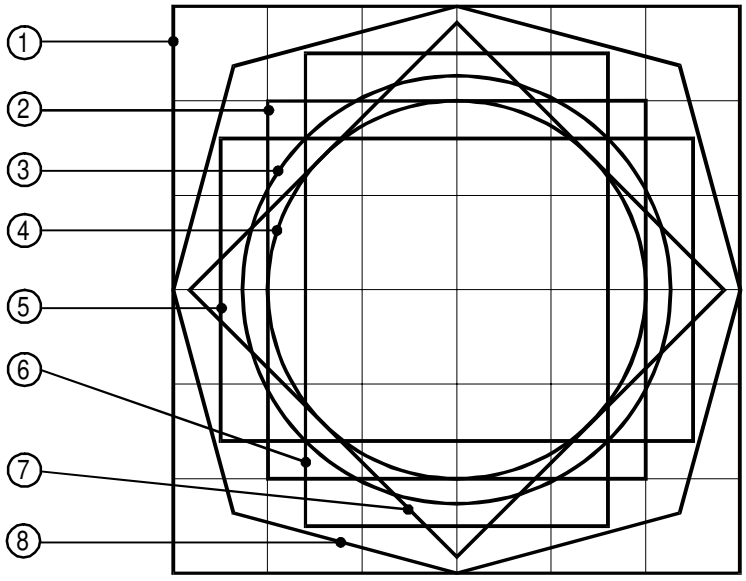
The negation cross can be used to indicate a negated, cancelled or opposite functions. The meaning of a negation depends on the employment of the symbol to be negated. For example, in the case of a symbol identifying the control for a function, a negation normally indicates the negated function or cancellation as in example of figure 4. In the case of a symbol indicating a functional state, the negation normally indicates the opposite functional state as in example b) of figure 4. Where the purpose of a symbol is to elicit an action (for example, an instruction), a negation is normally used to elicit the opposite action.

NOTE – The standardization of a negated graphical symbol is only necessary if the negated version represents a specific meaning. A diagonal bar running from top left to bottom right indicates a negation in `public information' and therefore should not be used.

7 Basic pattern

7.1 Structure

The basic pattern shown in figure 4 shall be used as the basis for the creation of a symbol original (see 7.2). It is used as a tool for the design of a graphical symbol to ensure a balanced visual impression or apparent size.



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 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 and a width of 40 mm and of height 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; the outer border of the basic pattern.

Figure 4 – Basic pattern.

7.2 Application of the basic pattern

To achieve a visual impression of uniformity and apparent size amongst graphical symbols, the symbol original shall fit into the basic pattern according to the following principles:

a) For a graphical symbol consisting of a single geometrical form, such as a circle, a square or a rectangle, the corresponding geometrical forms of the basic pattern should be used;

b) For the other graphical symbols, care should be taken to ensure that the graphical symbols have the same apparent size and are consistent with those in IEC 60417-2;

c) The key element in the basic pattern with regard to apparent 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 apparent size as the 50 mm basic square 2. Circles with external parts should be drawn on the circle 4;

d) Symbol originals should be designed to the largest size possible while ensuring the correct relative and apparent size and shall not extend beyond the octagon 8 of the basic pattern;

e) The lines of the graphical symbol should be centred on the lines of the basic pattern wherever possible.

In case that the centre of a line being in contact with the octagon 8, the half of the thickness of the line may extend beyond the octagon, however, the outer border of the line shall not exceed the 75 mm square 1 of the basic pattern as shown in figure 5.

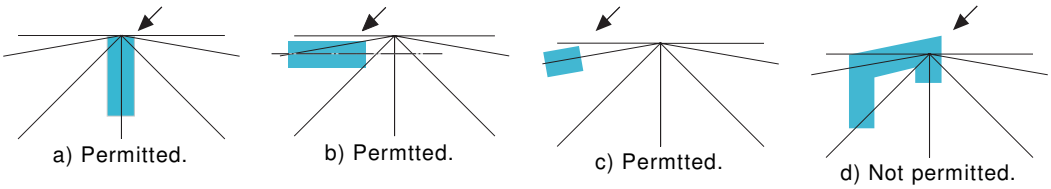
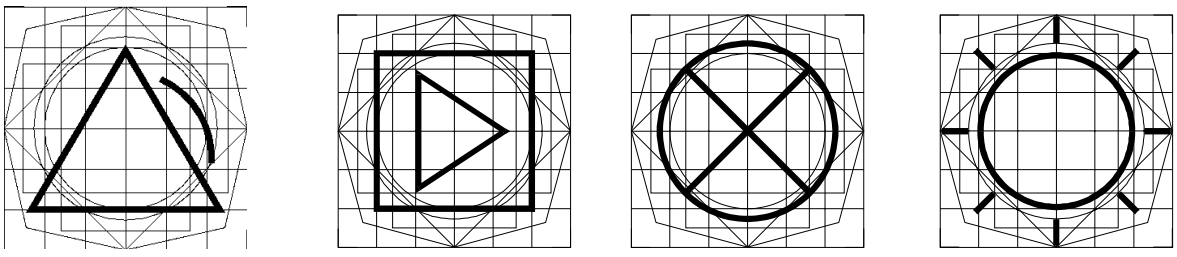


Figure 5 – Examples of permitted and not allowed and not permitted lines beyond the octagon.

Some examples of application of the basic pattern are shown in figure 6.

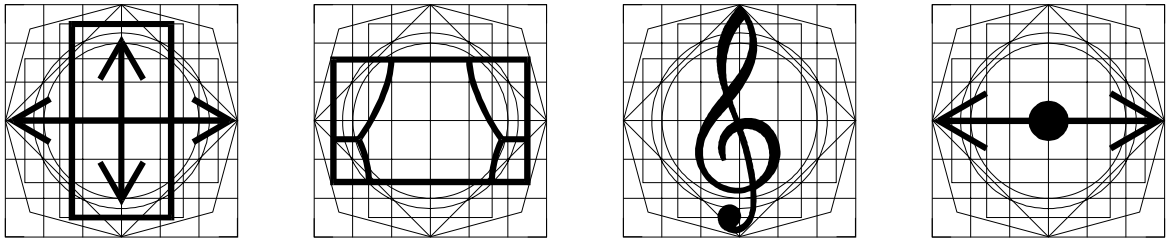


a) IEC 60417-5307
Alarm, general

b) IEC 60417-5084
Amplifier

c) IEC 60417-5115
Signal lamp

d) IEC 60417-5056
Brightness; brilliance



e) IEC 60417-5396
Patient support

f) IEC 60417-5604
Curtains

g) IEC 60417-5037
Treble control

h) IEC 60417-5027
Effect of action

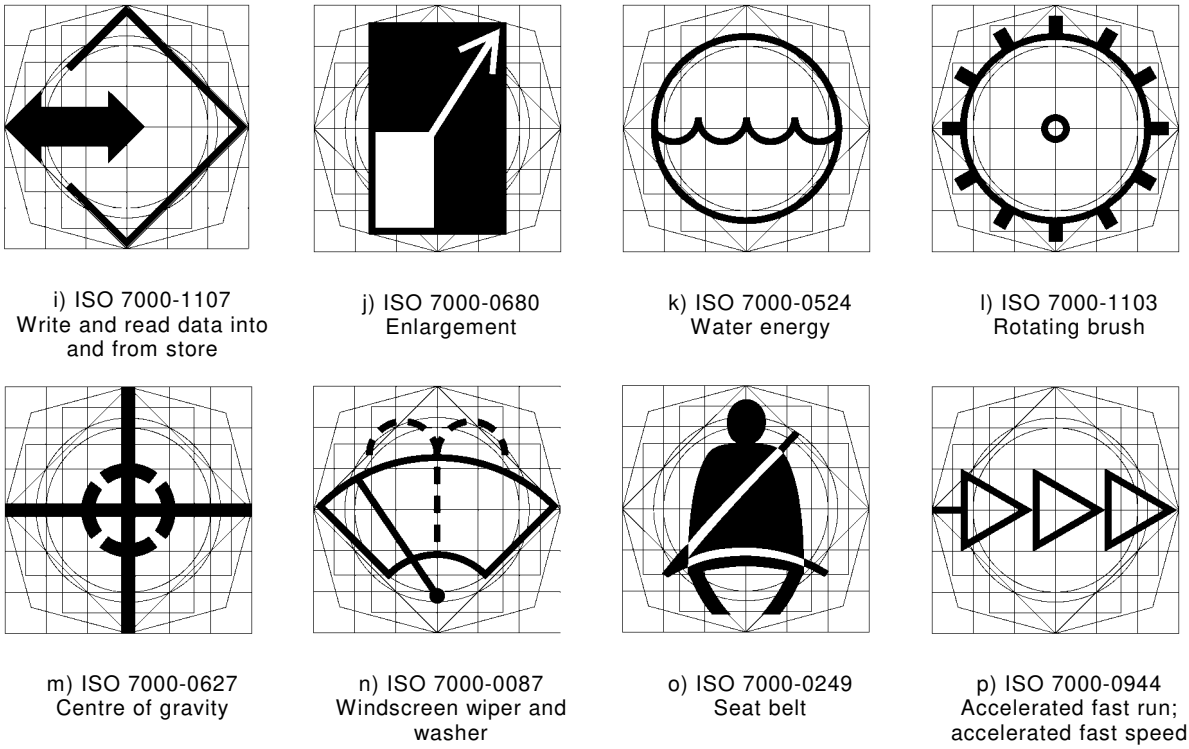


Figure 6 – Application examples. (*better examples are under consideration*)

7.3 Symbol original

The symbol original is a drawing of the graphical symbol in accordance with the basic pattern, including the corner markings shown in figure 7. The corner markings correspond to the corners of the 75 mm square 1 of the basic pattern in figure 4 and are used to facilitate accurate scaling of the graphical symbol.

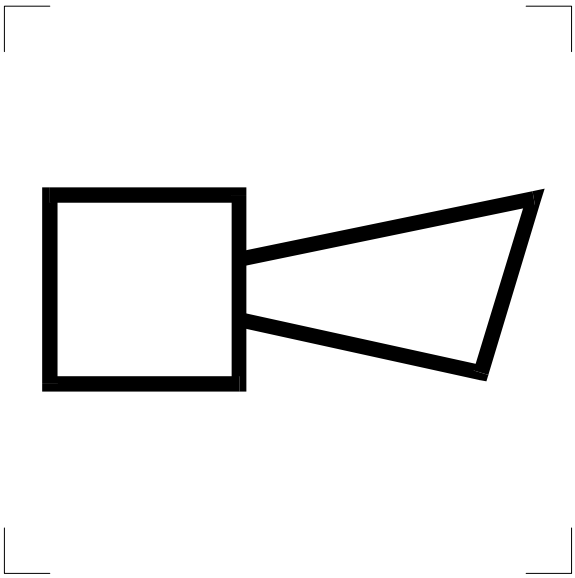


Figure 7 – An example of symbol original.
IEC 60417-5014

NOTE 1 – The apparent size of graphical symbols drawn using the basic pattern corresponds to the 50 mm nominal size. The apparent size of the graphical symbol can be increased or reduced by rescaling accordingly. Thus, to achieve an apparent size of 5 mm, symbols originals need to be reduced to 10 % of their nominal size.

NOTE 2 – Where the intended size of reproduction of a graphical symbol is small, or the viewing distance is large, for example on a small key cap, particular attention should be given to avoiding unnecessary detail and complexity in the design of the graphical symbol. It should be noted that legibility also depends upon other factors such as the level of illumination and luminance contrast.

8 Creation procedure

Creation of a graphical symbol should follow the following procedure:

a) identification of a need for the graphical symbol;

b) clear and unambiguous description of the purpose of the graphical symbol and identification of any orientation factors (see 4.2);

c) analysis of the characteristics of the intended users, the task involved and context of use:

d) consideration of existing or proposed graphical symbols in the same and/or related fields;

e) design of the graphical symbol as described in 7;

f) consideration of legibility and comprehension of the graphical symbol in the context of its use;

g) modification, if necessary;

h) adoption of a designation specified in 8.

NOTE – The degree of comprehension may be influenced by education of the target users and/or the provision of instructional material.

9 Designation systems

Any graphical symbol shall have only one registration number, either from IEC/SC 3C or from ISO/TC 145. The designation system applied to each graphical symbol in IEC 60417 and ISO 7000 consists of the following:

a) the reference of the International Standard, either IEC 60417 or ISO 7000;

b) a hyphen;

c) the registration number of the graphical symbol.

EXAMPLE: IEC 60417-5115,
ISO 7000-0091.

NOTE – Registration numbers below 5000 have been assigned to ISO 7000 and numbers above 5000 have been assigned to IEC 60417.

In exceptional cases where there are two alternative graphical representations for one function, these are distinguished by the addition of a letter after the registration number.

EXAMPLE: IEC 60417-5107A, IEC 60417-5107B.

Where the addition of a qualifying element to a symbol results in a new meaning, the derived symbols have the registration numbers with dashed suffixes.

EXAMPLE: IEC 60417-5277-1, IEC 60417-5277-2.....

Annex A
(Informative)

Adaptation of graphical symbols for use on equipment

In practice, to improve the appearance and perceptibility of a standardized graphical symbol in use, or to coordinate with the design of the equipment to which it is to be applied, it may be necessary, for example,

a) to change the line thickness,

b) to round the corners,

c) to fill areas of the graphical symbols,

d) to modify the design of arrows according to ISO 80416-2.

The user is normally free to make such changes provided that the essential perceptual characteristics of the graphical symbol are maintained.

Bibliography

IEC 60027-1: 1992, Letter symbols to be used in electrical technology – Part 1: General; Amendment No. 1 (1997).

IEC 60027-2: 1972, Letter symbols to be used in electrical technology – Part 2: Telecommunications and electronics; Amendment No. 1 (1997); First supplement (1975) and second supplement (1980).

IEC 60027-3: 1989, Letter symbols to be used in electrical technology – Part 3: Logarithmic quantities and units.

IEC 60027-4: 1985, Letter symbols to be used in electrical technology – Part 4: Symbols for quantities to be used for rotating electrical machines.

IEC 60617-1: 1985, Graphical symbols for diagrams – Part 1: General information, general index, cross-reference tables.

IEC 60617-2: 1996, Graphical symbols for diagrams – Part 2: Symbol elements, qualifying symbols and other symbols having general information.

IEC 60617-3: 1996, Graphical symbols for diagrams – Part 3: Conductors and connecting devices.

IEC 60617-4: 1996, Graphical symbols for diagrams – Part 4: Passive components.

IEC 60617-5: 1996, Graphical symbols for diagrams – Part 5: Semiconductors and electron tubes.

IEC 60617-6: 1996, Graphical symbols for diagrams – Part 6: Production and conversion of electrical energy.

IEC 60617-7: 1996, Graphical symbols for diagrams – Part 7: Switchgear, controlgear and protective devices.

IEC 60617-8: 1996, Graphical symbols for diagrams – Part 8: Measuring instruments, lamps and signalling devices.

IEC 60617-9: 1996, Graphical symbols for diagrams – Part 9: Telecommunications – Switching and peripheral equipment.

IEC 60617-10: 1996, Graphical symbols for diagrams – Part 10: Telecommunications – Transmission.

IEC 60617-11: 1996, Graphical symbols for diagrams – Part 11: Architechtual and topographical installation plans and diagrams.

IEC 60617-12: 1997, Graphical symbols for diagrams – Part 12: Binary logic elements

IEC 60617-13: 1993, Graphical symbols for diagrams – Part 13: Analogue elements.

ISO/IEC 11714-1: 1996, Design of graphical symbols for use in the technical documentation of products – Part 1: Basic rules.

ISO 31 (parts 0 to 13): 1992, Quantities and units.

ISO 3098: 1974, Technical drawlngs - Lettering - Part 1: Currently used characters.