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General principles for the creation of graphical symbols —

Part 1 : Graphical symbols for use on equipment

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Principes généraux pour la création de symboles graphiques —

Partie 1 : Symboles graphiques utilisables sur le matériel ISO 3461-1:1988

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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 3461-1 was prepared jointly by Technical Committee ISO/TC 145, *Graphical symbols*, and Technical Committee IEC/TC 3, *Documentation and graphical symbols*, and is also published as IEC 416 : 1988.

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ISO 3461-1 : 1988 and IEC 416 : 1988 cancel and replace ISO 3461 : 1976 and IEC 416 : 1972 which have been harmonized to produce this part of ISO 3461.

ISO 3461 consists of the following parts, under the general title *General principles for the creation of graphical symbols* :

- *Part 1 : Graphical symbols for use on equipment*
- *Part 2 : Graphical symbols for use in technical product documentation*

All standards are subject to revision, and users should note that at the time of publication, the editions of the standards referenced herein were valid. Members of IEC and ISO maintain registers of currently valid International Standards.

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General principles for the creation of graphical symbols —

Part 1 : Graphical symbols for use on equipment

1 Scope

This part of ISO 3461 specifies the basis for the creation of graphical symbols for use on equipment. It contains rules for designing symbols, including their shape and size, and instructions for their application.

Graphical symbols for use on equipment may be employed

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

This part of ISO 3461 does not apply to graphical symbols primarily intended for

- use on drawings;
- use in technical product documentation;
- public information.

However, graphical symbols initially developed for such purposes (see IEC 617, ISO 3461-2, ISO 7001 and ISO/TR 7239) may be used on equipment, provided that they are drawn in accordance with the principles laid down in this part of ISO 3461.

2 References

IEC 27 (parts 1 to 4), *Letter symbols to be used in electrical technology*.

IEC 417 : 1973, *Graphical symbols for use on equipment — Index, survey and compilation of the single sheets*.

IEC 617 (parts 1 to 13), *Graphical symbols for diagrams*.

ISO 31 (parts 0 to 13), *Quantities, units and symbols*.

ISO 3461-2 : 1987, *General principles for the creation of graphical symbols — Part 2 : Graphical symbols for use in technical product documentation*.

ISO 3864 : 1984, *Safety colours and safety signs*.

ISO 4196 : 1984, *Graphical symbols — Use of arrows*.

ISO 7000 : 1984, *Graphical symbols for use on equipment — Index and synopsis*.

ISO 7001 : 1980, *Public information symbols*.

ISO/TR 7239 : 1984, *Development and principles for application of public information symbols*.

3 Definitions

For the purposes of this part of ISO 3461, the following definitions apply.

3.1 graphical symbol: Visually perceptible figure used to transmit information independently of language. It may be produced by drawing, printing or other means.

NOTE — Internationally standardized letter symbols according to ISO 31 and IEC 27 may be considered to be graphical symbols.

3.2 graphical symbol elements: Parts of a graphical symbol.

NOTES

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

2 Letters, numerals, punctuation marks and mathematical symbols may be used as graphical symbol elements.

3.3 (symbol) original: Design of a graphical symbol, prepared in accordance with this part of ISO 3461, used for reference or reproduction purposes.

4 Meaning

The meaning assigned to each graphical symbol is expressed by its title which may be supplemented by an application note. The meaning shall be unambiguous and independent of terms related to a special technique or discipline.

The meaning of a graphical symbol may depend on its orientation and care shall be taken to avoid ambiguity (see 8.2).

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 elements used.

6 Shape

The shape of a graphical symbol should be

- simple, in order to facilitate perception and reproduction;
- readily distinguishable from those of other graphical symbols with which it may be used;
- easily associated with its intended meaning, i.e. either self-evident or easily learnt.

For the design of graphical symbols on safety signs, see ISO 3864.

7 Design principles

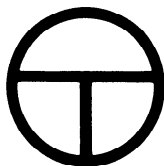
7.1 A graphical symbol shall be designed within the basic pattern (see clauses 8 and 9, and figure 3).

7.2 The shape of graphical symbols shall be such that it can be produced by the usual manufacturing methods (e.g. etching, engraving, printing and photographic means).

7.3 In general, line thicknesses shall be either 2 mm or 4 mm on the symbol originals. For visual clarity, a combination of both line thicknesses may be used. Examples are shown in figure 1.



a) Microphone (basic symbol)



b) On/off (push button)



c) Horizontal picture shift (e.g. television screen)

Figure 1 — Examples of line-thickness combinations

7.4 The minimum spacing between lines 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 be not less than 1,5 times the minimum line thickness.

7.5 Angles smaller than 30° should be avoided.

7.6 Filled areas should be avoided.

7.7 When designing graphical symbols which incorporate arrows, the principles established in ISO 4196 shall apply.

7.8 A simple type-face should be used for constituent graphical symbol elements such as letters, numerals, punctuation marks and mathematical symbols. In the symbol original, the lettering height shall be at least 10 mm.

7.9 The use of colours should be an additional aid rather than a basic informative element for the meaning of a graphical symbol.

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8 Design procedure

8.1 Procedure

Graphical symbol design should follow the following procedure :

- a) identification of a need for a graphical symbol;
- b) clear and unambiguous description of the purpose of the graphical symbol and identification of any positioning factors (see 8.2);
- c) analysis of the environmental and application factors;
- d) consideration of existing or proposed graphical symbols in the same and/or related fields;
- e) design of the graphic form as described in clause 9;
- f) testing of the graphical symbol for legibility, comprehensibility, etc.;
- g) modification, if necessary.

8.2 Orientation of the graphical symbol

The majority of graphical symbols preserve their meaning in any orientation [see figure 2a)]. However, when the meaning of a graphical symbol does depend on its orientation, this shall be explicitly stated [see figure 2b)].

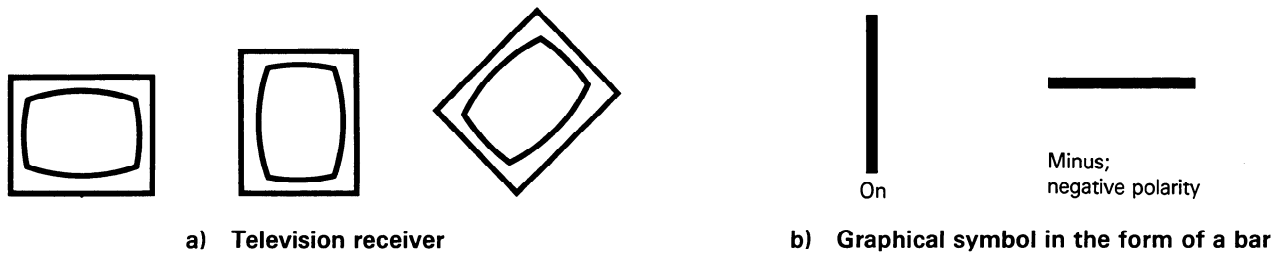
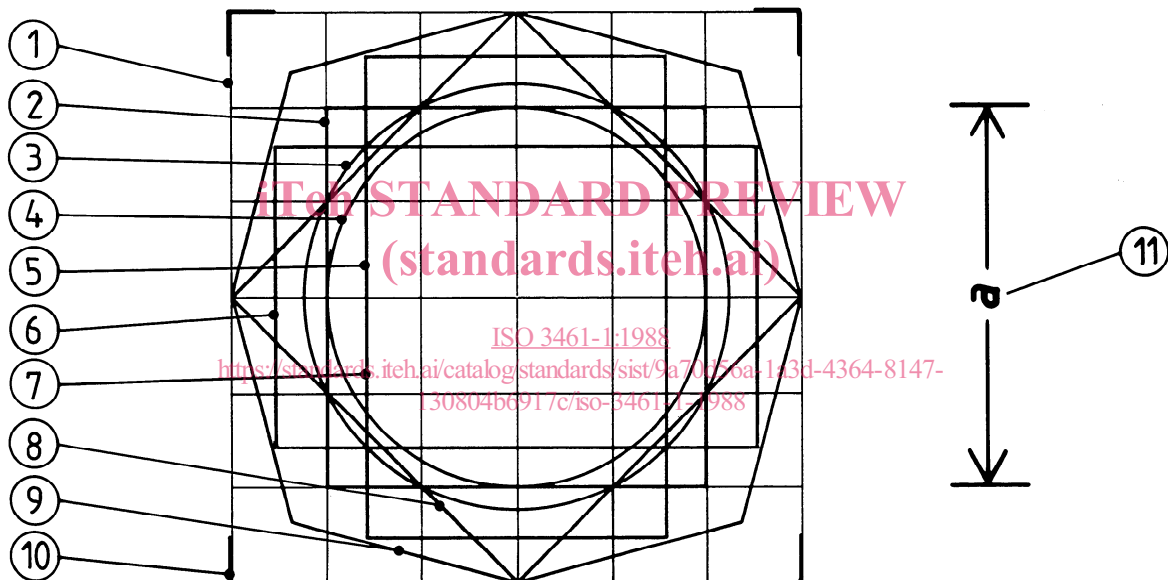


Figure 2 — Graphical symbols, the meaning of which is a) independent of orientation and b) dependent on orientation

9 Basic pattern

9.1 Structure

The basic pattern (see figure 3) should be used as a tool for the design of graphical symbols to ensure a balanced visual impression and weight. It shall be used as the basis for the design of the symbol originals (see 9.2).



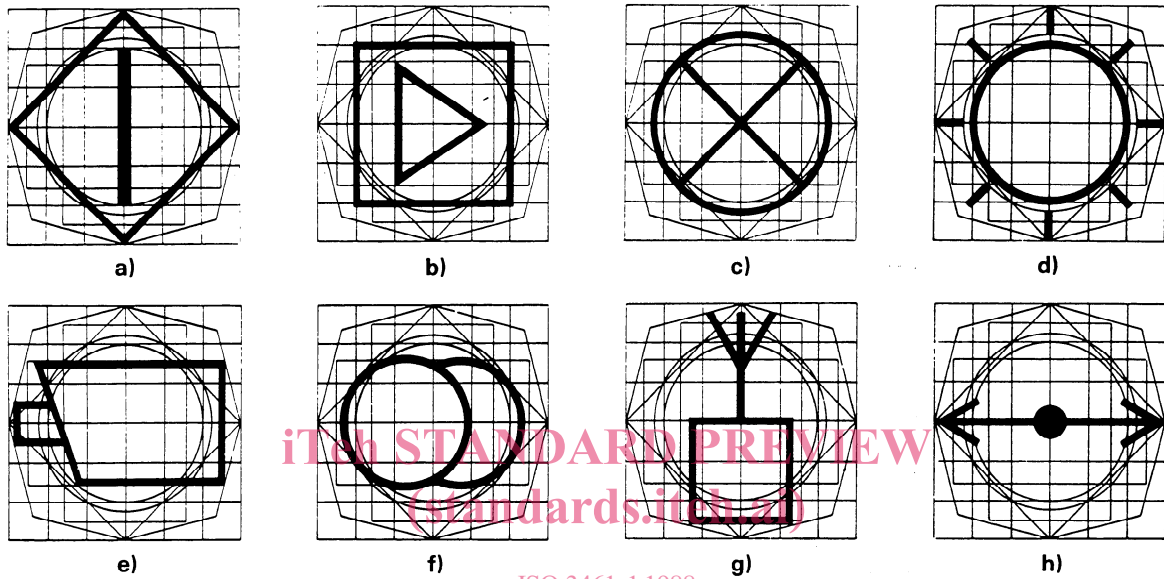
Reference	Description
1	Square of 75 mm lateral length, divided into a grid of 12,5 mm line spacing.
2	Basic square of 50 mm lateral length. This dimension is equal to the nominal dimension α of the symbol original.
3	Basic circle of 56,6 mm diameter, having approximately the same surface area as the basic square 2.
4	Circle of 50 mm diameter, being the inscribed circle of the basic square 2.
5	Square of 40 mm lateral length which touches the basic circle 3 with its corners.
6, 7	Two rectangles having the same surface area as the basic square 2. They are mutually perpendicular, each drawn to cross symmetrically opposite sides of the basic square 2.
8	Square formed by lines joining the mid-point of the sides of square 1 and forming the largest horizontal and vertical dimensions of the basic pattern.
9	Irregular octagon formed by lines at 30° to the sides of square 8.
10	Corner markings at the outermost corners of the basic pattern (see 9.3).
11	Nominal dimension, $\alpha = 50$ mm (see 9.3).

Figure 3 — Basic pattern

9.2 Application of the basic pattern

To achieve a visual impression of uniform size and optical weight among graphical symbols, the symbol original should be fitted into the basic pattern according to the following principles :

- 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;
- the lines of the graphical symbol should be centred on the lines of the basic pattern wherever possible;
- care should be taken to ensure that graphical symbols are given equal size and optical weight. For example, a circle without external parts should be drawn on basic circle 3 [see figure 4c)], whereas a circle with external parts should be drawn on circle 4 [see figure 4d)].



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 Figure 4 — Examples of application

9.3 Nominal dimension, corner markings and visual-centring lines

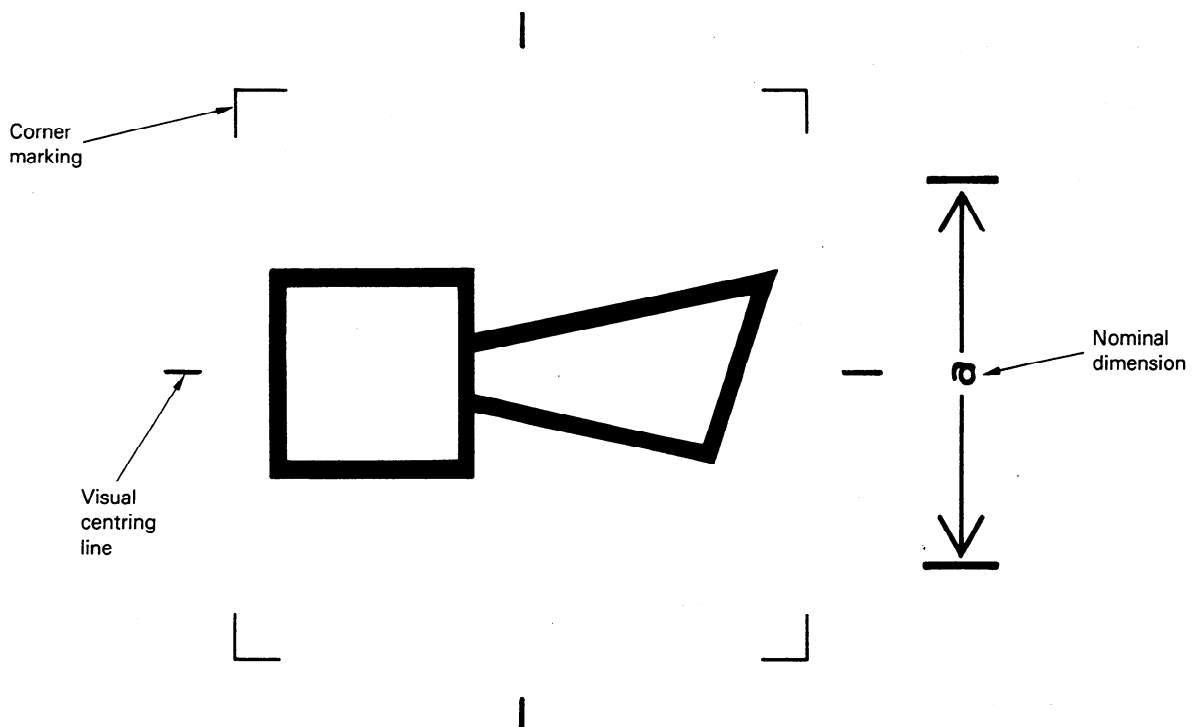


Figure 5 — Symbol original, original (master) design with corner markings, nominal dimension and visual-centring lines

9.3.1 Nominal dimension

The dimension a is the nominal dimension, equal to 50 mm for symbol originals. The real dimensions of graphical symbols often differ from the nominal dimension and are expressed as a proportional factor of a as illustrated in the following examples.

EXAMPLE 1

The real height and real width of the symbol original shown in figure 5 are 28 mm and 66,5 mm respectively which, in terms of the nominal dimension a of the symbol original, are as follows :

- real height = $0,56 a$ (i.e. $0,56 \times 50 \text{ mm} = 28 \text{ mm}$);
- real width = $1,33 a$ (i.e. $1,33 \times 50 \text{ mm} = 66,5 \text{ mm}$).

EXAMPLE 2

If it is decided that for use on equipment the graphical symbol shown in figure 5 should have a nominal dimension $a = 8 \text{ mm}$, the real dimensions of this graphical symbol will be as follows :

- real height of actual graphical symbol = $0,56 a = 0,56 \times 8 \text{ mm} = 4,48 \text{ mm}$;
- real width of actual graphical symbol = $1,33 a = 1,33 \times 8 \text{ mm} = 10,64 \text{ mm}$.

NOTE — In the examples given above, the height and width of the graphical symbol were chosen as the dimensions of interest. However, the same rules are applicable whichever dimension (height, width, diameter, etc.) of the graphical symbol is chosen as the dimension of interest.

The nominal dimension serves as reference gauge for photographic reproduction of the graphical symbol. Owing to the relationship between the nominal dimension and the real dimensions of the original, the proportions of a graphical symbol will remain the same, no matter whether it is enlarged or reduced.

9.3.2 Corner markings

The corner markings (see figure 5) are part of the symbol original, in order to facilitate reproduction and application.

9.3.3 Visual-centring lines

The four visual-centring lines mark at their imaginary point of intersection the perceptual centre of the graphical symbol. This perceptual centre point is an aid for the arranging or positioning of the graphical symbol in relation to its surroundings, or for balancing the arrangement of several graphical symbols in relation to each other as well as to their surroundings, and it thus aids achievement of the final visual impression.

NOTE — These visual-centring lines are required by IEC.

10 Use of graphical symbols

10.1 Use of the symbol originals

10.1.1 IEC practice

Graphical symbols may be copied and reduced in one process (e.g. by photographic means) directly from the symbol originals on the sheets of IEC 417. When using the appropriate graphical film, the blue grid will not copy.

10.1.2 ISO practice

For each graphical symbol registered in ISO 7000, the symbol original exists at the Secretariat of ISO/TC 145. Copies of all sizes and microfilm copies are available on request.

10.2 Use of restyled symbols

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

- change the line thickness,
- round the corners,
- fill areas of the graphical symbol.

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

10.3 Positioning of the graphical symbol

Care shall be taken to avoid ambiguity when using graphical symbols the meaning of which is dependent on their orientation. Such ambiguity could occur, for instance, when graphical symbols are placed on rotary knobs (see 8.2).

10.4 Size of the actual graphical symbol

To ensure correct recognition of an actual graphical symbol, the minimum value of its nominal dimension a , in units equivalent to those of the viewing distance, should be

$$a = \frac{L}{100}$$

where L is the viewing distance.