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General principles for the creation of graphical symbols —

Part 2:

Graphical symbols for use in technical product documentation

Principes généraux pour la création de symboles graphiques —

Partie 2:

Symboles graphiques à utiliser dans la documentation technique de produits

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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.

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 3461-2 was prepared by Technical Committees ISO/TC 10, *Technical drawings*, and ISO/TC 145, *Graphical symbols*.

This first edition of ISO 3461-2 together with ISO 3461-1 cancel and replace the previous edition (ISO 3461 : 1976), of which they constitute a revision.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

General principles for the creation of graphical symbols —

Part 2:

Graphical symbols for use in technical product documentation

0 Introduction

The purpose of this International Standard is to provide guidelines for the design, construction and interpretation of graphical symbols.

Graphical symbols used in technical product documentation (tpd), which covers drawings such as sketches, diagrams and plans, form part of the engineering language to convey information related to a product. This information concerns data on the various stages such as development, manufacturing, inspection, installation, maintenance, etc.

Graphical symbols may refer to concepts, individual indications, instructions or features, the latter not being restricted to physical characteristics but including conditions, interfaces, circumstances, facts and action.

The possibility of applying graphical symbols in technical product documentation should be subject to careful analysis since both the type of documentation and the level for which the information is intended have to be taken into account.

Types of technical documentation may vary between two extremes, one being a functional sketch illustrating only the basic functions of a machine, apparatus or process and the other being detailed product specification. In practice, many types of documentation may be found necessary based on the requirements of the specific manufacturer.

1 Scope and field of application

This part of ISO 3461 specifies the basis for the creation of graphical symbols for use on technical product documentation of

- production indications (e.g. for surface features);
- functional indications;

- objects for construction of equipment and installations;
- equipment.

2 References

ISO 128, *Technical drawings — General principles of presentation*.

ISO 3098-1, *Technical drawings — Lettering — Part 1: Currently used characters*.

ISO 3461-1, *General principles for the creation of graphical symbols — Part 1: Graphical symbols for use on equipment*.¹⁾

ISO 6428, *Technical drawings — Requirements for micro-copying*.

3 Definitions

For the purposes of this part of ISO 3461 the following definitions apply (3.1 and 3.2 are in accordance with ISO 3461-1).

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, *Quantities, units and symbols* and/or IEC Publication 27, *Letter symbols to be used in electrical technology* may be considered as 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.

1) At present at the stage of draft. (Revision, in part, of ISO 3461:1976.)

3.3 reference drawing: Design of a graphical symbol used in technical product documentation prepared in accordance with this International Standard for reference or reproduction in a grid of module $M = 10$ mm and line thickness of 1 mm.

NOTE — Module refers to a unit of size used as an increment step in dimensional coordination (in accordance with ISO 1791, *Building construction — Modular coordination — Vocabulary*).

3.4 technical product documentation: Formal technical documents specifying a product and needed for production, installation, servicing, using or procurement of that product.

NOTE — Technical product documentation may be abbreviated as tpd.

3.5 tpd-symbol: Graphical symbol used in technical product documentation to represent objects and/or functions or particular indications for production, inspection and installation.

NOTE — To apply tpd-symbols, standardized sizes in accordance with clause 11 are used.

4 General requirements

The configuration of a tpd-symbol shall be such that it can be drawn with common drawing instruments and drawing techniques. This necessitates taking the special requirements of hand-drawing techniques, microcopying (see ISO 6428) and computer graphics (plotter and printers) into account when designing a tpd-symbol.

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 symbol elements used.

6 Shape

The shape of a particular graphical symbol shall be

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

7 Design procedure

7.1 Procedure

Symbol design should follow this 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 7.2);

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 10;¹⁾

f) modification, if necessary.

7.2 Orientation of tpd-symbol

The majority of tpd-symbols preserve their meaning in any position. However, when the meaning depends on its orientation or position, this shall be explicitly stated (e.g. within the reference drawing).

8 Reference drawing requirements

8.1 Basic grid

tpd-symbols shall be designed and presented in reference drawings suitably enlarged if necessary, on a basic square grid of module $M = 10$ mm and line thickness of 1 mm, suitable for direct and indirect reproduction of the tpd-symbol and for documentation.

For the design of smaller details, auxiliary lines may be used by dividing the distance between grid lines into 10 equal parts (see the figure).

Grid lines as shown in the figure are imaginary only and have no thickness. The actual dimension of the grid (distance between grid lines) is irrelevant. For practical purposes it is however recommended that the module $M = 10$ mm (permitting the use of normal millimetre-paper) and a line thickness of 1 mm be used.

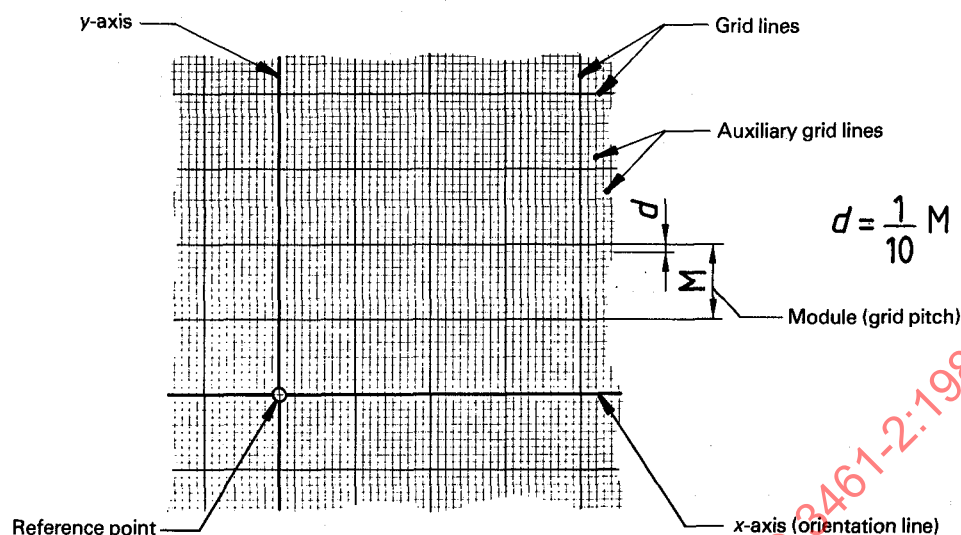
8.2 Reference point and orientation line

Within the basic grid, every tpd-symbol is assigned to an x-axis and a y-axis, the 0-point forming the reference point of the tpd-symbol and the x-axis ($y = 0$) the orientation line (see the figure).

The reference point may be positioned either in the centre of the tpd-symbol or on its outline or anywhere outside the tpd-symbol. However, all tpd-symbols of a symbol set shall have the same position from the reference point.

Endpoints of connecting lines are very suitable as reference points.

1) Details for the design of tpd-symbol sets with the aid of auxiliary lines (see 8.1) will be covered in a future addendum to this part of ISO 3461.



Figure

9 Functionally related tpd-symbols

It is recommended that functionally related tpd-symbols be designed as a set.

The characteristics of such a set of tpd-symbols may be

- similarity of shape;
- similarity of meaning;
- similarity of objects represented;
- similarity of application, etc.

Within the above similarities enough distinction between tpd-symbols should be achieved to avoid confusion.

tpd-symbol sets may be built from a basic tpd-symbol; derived tpd-symbols are developed by adding symbol elements.

Different tpd-symbols of one set should be shown in suitable sizes relative to each other.

10 Design principles

10.1 Size and outline

A tpd-symbol should be as small as practical. All horizontal and vertical outlines of the tpd-symbol shall coincide with the grid lines.

Sides of rectangles or diameters of circles should be multiples of $2M$. For small tpd-symbols $0,5M$, $1M$ or $1,5M$ may be used.

Vital points of the design such as centres of circles and arcs, and open ends of lines shall coincide with intersections of the grid lines or the centrelines between two grid lines ($0,5M$, $1,5M$, etc.).

Other points may be defined by any intersection of the auxiliary grid.

10.2 Connecting lines

Connecting lines of a tpd-symbol shall coincide with grid lines or be in the centre between two grid lines ($0,5M$, $1,5M$, etc.). The minimum distance between two connecting lines is $0,5M$. If however, writing is needed (terminal designations, signal names, etc.), the minimum distance shall be $2M$.

If connecting lines are shown, they shall end on a grid line crossing.

If connecting lines are not shown, their position shall be defined by coordinates.

10.3 General lines

The line thickness shall be $1/10M$. The module M should be chosen so that the standard ranges of lines according to ISO 128 or ISO 3098-1 can be used.

The same line thickness should be used for all parts of one tpd-symbol and for all tpd-symbols in one symbol set.

Lines shall neither intersect nor touch at an angle of less than 15° .

Lines which are not parallel to the grid lines should be positioned at angular increments of 15° (i.e. 15° , 30° , 45° , 60° , 75°). Oblique lines formed by a geometrical design (for example, a diagonal in a rectangle) may deviate from the angular increment of 15° .

The minimum distance between parallel lines shall be $2/10M$.

Curves should as far as possible consist of segments of circular arcs.

10.4 Characters

Letters, numbers and all other characters, if included in or associated with tpd-symbols should be clear: ISO 3098-1, type B vertical shall be preferred. The line thickness of these characters shall be the same as the line thickness of the tpd-symbol itself.

10.5 Shaded and hatched areas

Shaded (filled) areas should be avoided. If necessary, it is preferable to indicate by hatching or cross-hatching.

11 Application of tpd-symbols

For applications in technical product documentation, the tpd-symbol shall be suitably sized.

To make optimal use of standardized line thickness as given in ISO 128, the following sequence for module **M** with a rate of $\sqrt{2}$, is recommended: 1,8; 2,5; 3,5; 5; 7; 10; 14; 20 mm.

The line thickness corresponding to module **M** is given in the table (also see the figure).

Table

| Dimensions in millimetres | | | | | | | | | | |
|---------------------------|------|--------------------|-------------------|------|--------------------|-----------------|-----|------------------|-----|-----|
| Module M | 1,8 | 2,0 ¹⁾ | 2,5 ¹⁾ | 3,5 | 4 ¹⁾ | 5 ¹⁾ | 7 | 10 ²⁾ | 14 | 20 |
| Line thickness | | | | | | | | | | |
| $d = \frac{1}{10} M$ | 0,18 | 0,20 ³⁾ | 0,25 | 0,35 | 0,40 ³⁾ | 0,5 | 0,7 | 1,0 | 1,4 | 2,0 |

- 1) Used for computer graphics.
- 2) Module-size of the reference drawing.
- 3) Line thickness not in accordance with ISO 128.