INTERNATIONAL STANDARD

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Design of graphical symbols for use in the technical documentation of products —

Part 1: Basic rules

Création de symboles graphiques à utiliser dans la documentation technique de produits —
Partie 1: Règles fondamentales

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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 81714-1 was prepared jointly by Technical Committees ISO/TC 10, *Technical product documentation*, Subcommittee SC 10, *Process plant documentation and tpd-symbols*, and IEC/TC 3, *Information structures, documentation and graphical symbols*. The draft was circulated for voting to the national bodies of both ISO and IEC.

This second edition of ISO 81714-1 cancels and replaces the first edition (ISO 81714-1:1999), which has been technically revised.

ISO 81714 consists of the following parts, under the general title *Design of graphical symbols for use in the technical documentation of products*:

— *Part 1: Basic rules*

IEC 81714 consists of the following parts, under the general title *Design of graphical symbols for use in the technical documentation of products*:

— *Part 2: Specification for graphical symbols in a computer sensible form, including graphical symbols for a reference library, and requirements for their interchange*

— *Part 3: Classification of connect nodes, networks and their encoding*

Design of graphical symbols for use in the technical documentation of products —

Part 1:
Basic rules

1 Scope

This part of ISO 81714 specifies basic rules for the design of graphical symbols for use in the technical documentation of products, taking into account basic application needs.

NOTE Supplementary requirements for graphical symbols used in advanced computer-aided design systems are specified in IEC 81714-2 and IEC 81714-3.

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 129-1, *Technical drawings — Indication of dimensions and tolerances — Part 1: General principles*

ISO 6428, *Technical drawings — Requirements for microcopying*

ISO/IEC 8859 (all parts), *Information technology — 8-bit single-byte coded graphic character sets*

ISO/IEC 10367, *Information technology — Standardized coded graphic character sets for use in 8-bit codes*

ISO/IEC 10646, *Information technology — Universal Multiple-Octet Coded Character Set (UCS)*

ISO 80000-2, *Quantities and units — Part 2: Mathematical signs and symbols to be used in the natural sciences and technology*

3 Terms and definitions

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

3.1
graphical symbol
visually perceptible figure with a particular meaning used to transmit information independently of language

[ISO 17724:2003[6], 31]

NOTE 1 The graphical symbol may represent objects of interest, such as products, functions or requirements for manufacturing, quality control, etc.

NOTE 2 A graphical symbol is not to be confused with the simplified representation of products which is normally drawn to scale and which can look like a graphical symbol.

3.2
reference point
origin of the coordinate system used in the description of all the graphical elements of the graphical symbol

NOTE The reference point can be used for positioning and transformation, e.g. by creation of a mirror image, rotation, and displacement.

3.3
symbol family
set of graphical symbols with a common conception using graphical characteristics with specific meanings

3.4
connect node
location on a graphical symbol intended for connection

3.5
terminal line
line of a graphical symbol ending at a connect node

NOTE Most graphical symbols of non-electric character are not provided with terminal lines; most graphical symbols of electric character are provided with terminal lines.

3.6
text
data in the form of characters, symbols, words, phrases, paragraphs, sentences, tables, or other character arrangements, intended to convey a meaning, and whose interpretation is essentially based upon the reader's knowledge of some natural language or artificial language

[ISO/IEC 2382-1:1993[3], 01.01.03]

3.7
arc
curved line with no inflection point

3.8
variant
⟨graphical symbols⟩ alternative graphical symbol design for a given referent

[ISO 17724:2003[6], 79]

EXAMPLE An identified orientation of a graphical symbol with regard to the flow direction or transfer direction.

NOTE A variant can be based on the rotation and/or creation of a mirror image of the corresponding symbol, together with possibly other modifications such as relocation of inputs and outputs and reorientation of text.

4 Markers

In this part of ISO 81714, the marker shown in Figure 1 is used to illustrate positions of connect nodes.

Figure 1 — Marker

5 Design of graphical symbols

5.1 Graphic representation

Graphical symbols shall be designed to convey information concerning a function or a special requirement. This also applies when physical products are to be represented by graphical symbols.

5.2 Design procedure

The design of graphical symbols shall follow the rules defined in Clause 6, taking into account:

a) the description of what the graphical symbol is intended to represent;

b) the requirements pertaining to presentation on paper or other solid media and in data processing;

c) the analysis of the consequences when rotating, creating a mirror image or scaling (permitting different values of scaling factors on the x and y axes, if required);

d) a requirement for functionally related graphical symbols to be designed as a symbol family;

e) the normal application of the graphical symbol, e.g. for reference designation (see IEC 81346-1[13]), technical data;

f) if microcopying is intended, the additional requirements specified in ISO 6428.

6 Design principles

6.1 Shape

The shape of a graphical symbol shall be:

a) simple, in order to improve perceptibility and reproducibility;

b) easily associated with its intended meaning, i.e. either self-evident, or easy to learn and to remember. Graphical symbols with the same shape representing different information should be avoided.

Due to the limited number of graphical elements and the limited number of combinations of these elements, different meanings may have to be assigned to graphical symbols having the same shape. In these cases, a separate graphical symbol shall be assigned to each meaning, provided with separate symbol identifiers (see 6.16).

Graphical symbols with different shapes shall not represent the same information.

For a human reader, the meaning of a graphical symbol can normally be recognized because of the context of the document. If not, such graphical symbols shall be provided with supplementary information.

6.2 Operational state

Graphical symbols having an element representing a movable part in a product, e.g. a valving element in a directional control valve for fluid power and a contact in an electromechanical switching device, shall be designed in a position that corresponds to:

a) the at-rest (unaffected) position for products with automatic return (e.g. a spring-loaded safety valve, a relay with spring return);

b) the non-active position for products without automatic return (e.g. a shut-off valve in a closed position, an electromechanical switching device in open-circuit position).

If operational states other than those specified in this part of ISO 81714 are required, the relevant information should be given in the standard for graphical symbols and in the diagram where such operational state occurs.

6.3 Classes of graphical symbols

Two classes of graphical symbols are recognized:

a) class 1 — graphical symbols providing basic information;

b) class 2 — graphical symbols providing supplementary information.

Graphical symbols belonging to class 2 should as far as possible be designed without relation to any specific context in order to make their application as broad as possible. These graphical symbols are intended to be used only together with graphical symbols of class 1. Graphical symbols belonging to class 1, normally reduced in size, may also be used to provide supplementary information (see Figures 2 and 3).

NOTE The graphical symbols providing the basic information for a pump as shown in Figure 2, and for an electrostatic microphone as shown in Figure 3, are used in each of the combinations as a graphical symbol giving supplementary information.

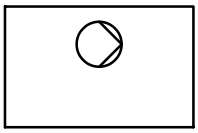


Figure 2 — Pumping system

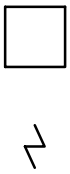
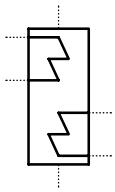
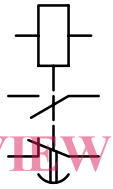
Figure 3 — Electrostatic microphone

6.4 Combination of graphical symbols

6.4.1 General

Graphical symbols may be combined to form a new graphical symbol. The information represented by the new composite graphical symbol shall be consistent with the information represented by its constituents. Examples of combinations of graphical symbols are shown in Table 1.

Table 1 — Examples of combinations of graphical symbols

Example	Graphical symbol	Assigned description	Composite graphical symbol	Assigned description
1		Envelope, tank, vessel Heating or cooling coil		Heat exchanger with three flow paths
2		Seat of a non-return valve Moving part of a non-return valve		Non-return valve
3		Relay coil Mechanical link Making contact Breaking contact Delay		Electromechanical relay provided with a closing contact and a delayed breaking contact
NOTE The dotted lines shown in Examples 1 and 2 are not part of the graphical symbol (see 6.12).				

6.4.2 Graphical symbols for complex assemblies

The graphical symbol representing an assembly shall be constructed by combining the graphical symbols representing the constituents of that assembly.

If the graphical symbol for a complex assembly, either for reasons of complexity or lack of graphical symbols representing the constituents, cannot be constructed in the above way, the following applies.

The graphical symbol shall be based on a simple solid outline. The outline should preferably be that of a square or, if necessary, a rectangle or any other closed shape. The graphical symbol shall be supplemented, preferably within this outline, by at least one of a) to f):

a) graphical symbol(s) representing the most significant constituent(s) (see Figure 2);

b) mathematical signs and/or expressions, letter symbols for quantities, chemical formulae, graphs and symbols from International Standards — mathematical signs shall be in accordance with ISO 80000-2 (see Figure 4);

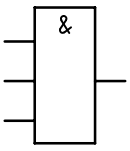


Figure 4 — AND element

c) an abbreviation, preferably mnemonic, based on the English language (see Figure 5);

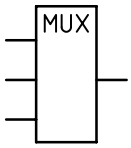


Figure 5 — Multiplexer

d) graphical symbols providing supplementary information related to each input and each output (see Figure 6);

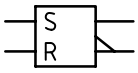


Figure 6 — Bistable element

e) graphical symbols providing supplementary information related to the assembly as a whole, located inside or outside the continuous outline (see Figure 7);

Figure 7 — Feedback controller and radio system

f) if it is impossible to describe the meaning of the graphical symbol by the methods given in a) to e), the addition of a short descriptive text.

The text specified in f) should be written in English, independent of the language(s) used, e.g. in a diagram. However, for use limited to a defined language region, a different language may be used. The text may be located inside or outside the outline (see Figure 8) and should be as short as possible.

NOTE Location of the text outside the outline distinguishes an international graphical symbol from language-related information and facilitates reproduction in different languages.

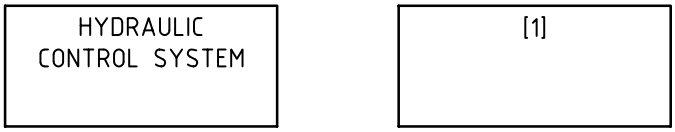


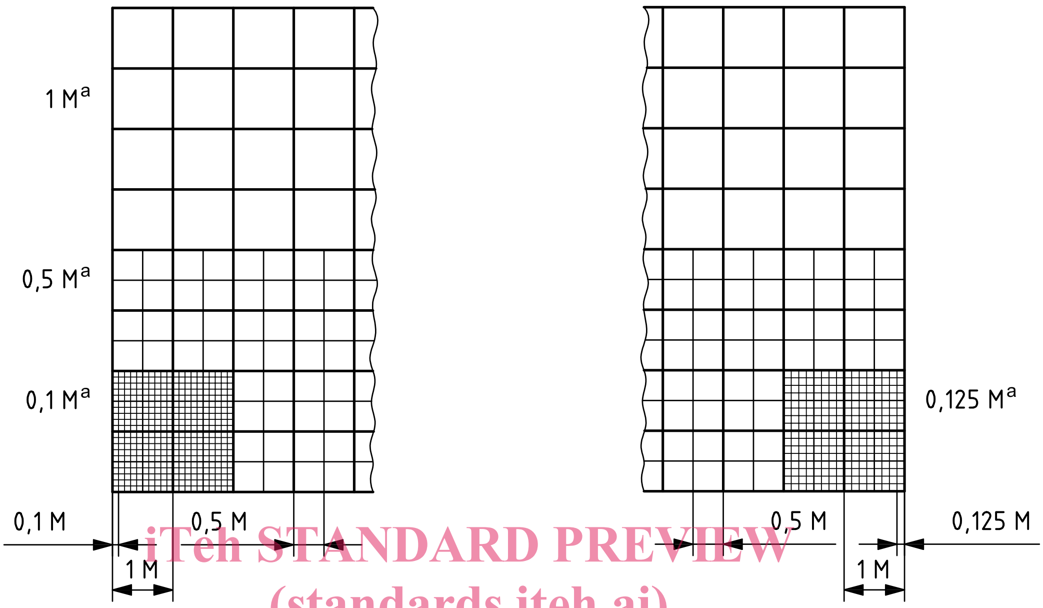
Figure 8 — Hydraulic control system

6.4.3 Graphical symbols including flow direction

Graphical symbols applying a flow direction, used to provide supplementary information, shall be applied in such a way that the overall flow is emphasized (see Figure 17).

6.5 Grid; module

As a basis for the design of a graphical symbol, an orthogonal grid of parallel lines spaced 1 M apart, where M is the module, shall be used. This grid may be subdivided into a 0,1 M or a 0,125 M grid (see Figure 9). For the same graphical symbol or symbol family, only one of these two grid systems shall be used and indicated in an appropriate document. For the selection of the module M, see 6.6.



a Grid.

Figure 9 — Examples of grids

6.6 Line width and module size

The relation between the line width and the module size M used for the design of graphical symbols shall be 1:10. Characters and lines of graphical symbols should have the same line width. Standardized line widths given in ISO 128-20[1] should be used.

If additional line widths are required, the ratio between any two line widths should be at least 2:1.

6.7 Lines and arcs

Line types should be in accordance with ISO 128-20[1]. Lines which come into contact or intersect at an acute angle should not have angles of less than 15°. Straight lines which do not run parallel to grid lines should have increments of 15° or should be defined with gradient ratios, e.g. 1:1, 2:1, 3:1, 4:1. Straight lines should begin and end on an intersection of the grid.

The end points of an arc shall lie on intersections of the grid. Curves shall consist only of arc segments and/or straight lines.

The following applies to straight lines and arcs defining the outline of a graphical symbol on which connect nodes are required (see Figure 10):

a) the axis of horizontal and vertical lines shall lie on the 0,5 M or 1 M grid;

b) the axis of inclined lines or arcs shall intersect as many intersections of the 0,5 M grid as connect nodes are needed.

