
**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.

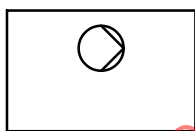


Figure 2 — Pumping system



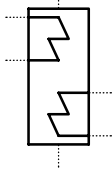
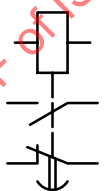
Figure 3 — Electrostatic microphone

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):

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

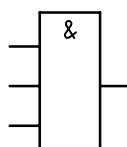


Figure 4 — AND element

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

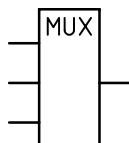


Figure 5 — Multiplexer

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

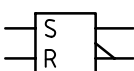


Figure 6 — Bistable element

- 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.

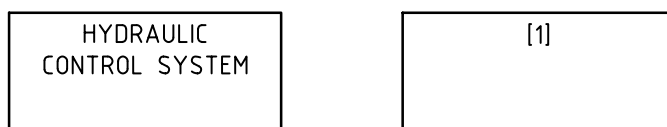


Figure 8 — Hydraulic control system

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.

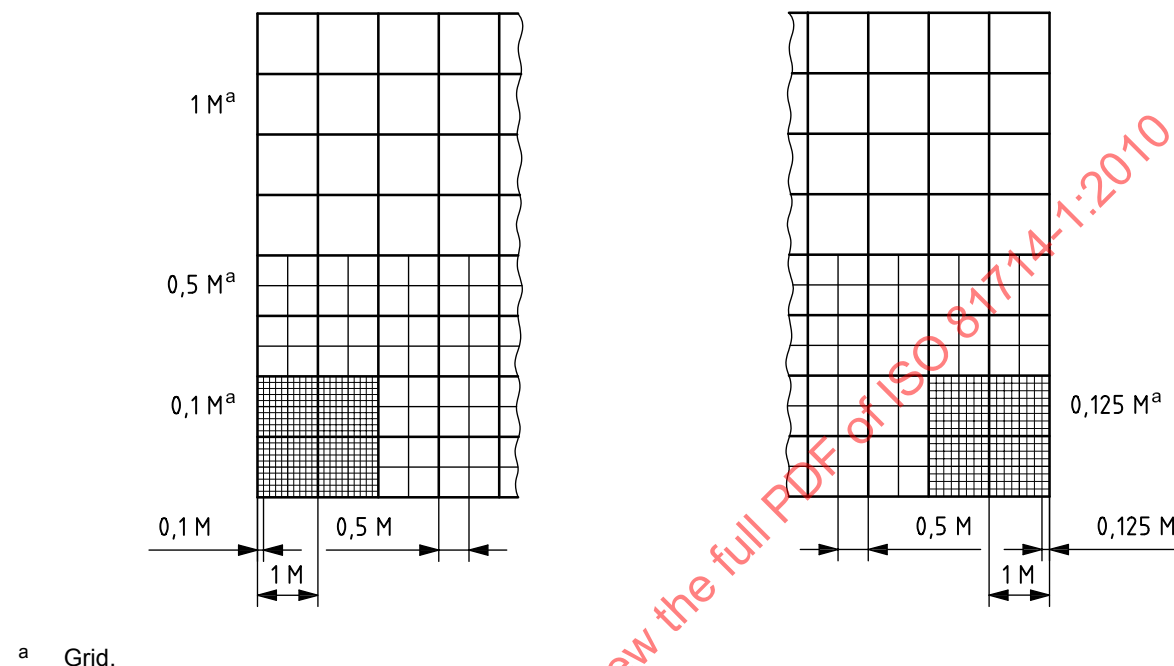


Figure 9 — Examples of grids

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.

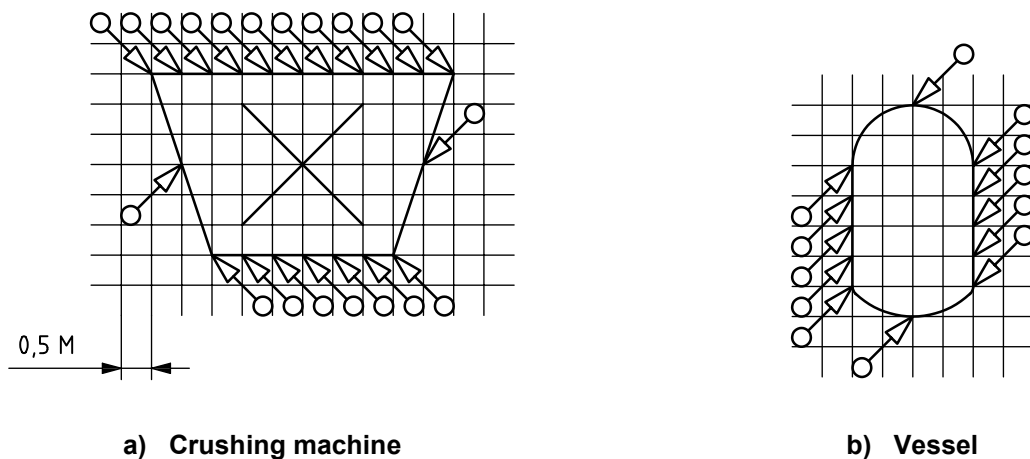


Figure 10 — Examples of graphical symbol outlines containing connect nodes

6.8 Minimum space between parallel lines

The minimum space between parallel lines shall be at least twice the line width of the widest line.

6.9 Hatched and filled areas

For hatched areas, the requirements with respect to the minimum space between parallel lines and to the line width shall be applied.

Filled areas should be avoided.

6.10 Connect node

If required, the graphical symbol should be provided with the appropriate number of connect nodes representing inputs and outputs.

6.11 Position of a connect node

A connect node should lie on an intersection of the 1 M or the 0,5 M grid (e.g. see Figure 10).

If it is intended to position text between connect nodes or parallel terminal lines, the minimum space between these nodes or lines shall be 2 M.

For more detailed information, see IEC 81714-2.

6.12 Terminal line

If terminal lines are required, they should be as short as practicable with regard to the space required for the terminal or port designations.

In those cases where the graphical symbol does not include terminal lines and the connection lines should be attached to the graphical symbol in a specific manner, the connection lines should be indicated by dotted lines (see Table 1, examples 1 and 2).

6.13 Reference point

For use in computer-aided systems, graphical symbols require a reference point. The reference point shall lie on an 0,5 M or 1 M intersection of the same grid as that used for the design of the graphical symbol.

For more detailed information, see IEC 81714-2.

Further recommendations regarding the location of the reference point may be given in other relevant International Standards.

6.14 Text assigned to graphical symbols

6.14.1 Typeface of characters

The typeface of characters should comply with ISO 3098-2^[4], type B vertical, where applicable. Letter symbols of quantities, as shown in ISO 80000^[10], IEC 80000^[11], and IEC 60027^[7] are recommended.

6.14.2 Set of characters

Any text within graphical symbols should be composed from standard character sets. To maintain compatibility with computer processing, characters should be restricted to those characters encoded in the ISO/IEC 646^[2] 7-bit character set, International Reference Version (IRV), excluding control and national replacement characters. If additional characters are required, they shall be selected from existing coded character sets, i.e. ISO/IEC 8859, ISO/IEC 10367, and ISO/IEC 10646.

6.14.3 Text orientation

The orientation of text (reading direction) shall comply with the rules for the orientation of dimensioning values in ISO 129-1, limited to horizontal and vertical values.

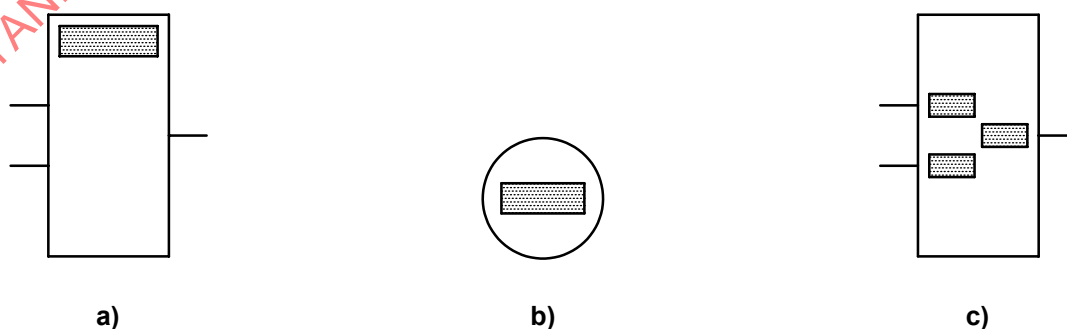
6.14.4 Location of text inside an outline

Text related to the graphical symbol as a whole should preferably be placed in the top centre [see Figure 11 a)] or alternatively in the middle [see Figure 11 b)] of the outline of the graphical symbol.

Text related to input or output shall be placed next to the relevant input or output [see Figure 11 c)].

6.14.5 Minimum distances

The minimum space between a text and its surrounding geometry shall be at least twice the line width, d , of the wider line (see Figure 12).



NOTE The filled-in areas show the areas occupied by the text.

Figure 11 — Examples of text location

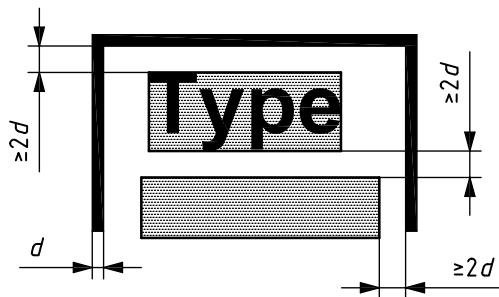


Figure 12 — Minimum distances between text and lines

6.15 Size of graphical symbols

The size of a graphical symbol should take into account space requirements, such as included text, included constituent graphical symbols, other graphical details, location and number of connect nodes.

6.16 Symbol identifier

Each graphical symbol published in an International Standard shall have an identification number unambiguous within the domain of the International Standard. The identification number shall be maintained during its life cycle.

For more detailed information, see IEC 81714-2.

7 Modification of proportions

The standardized proportions of graphical symbols should be as shown in relevant International Standards (IEC 60617^[8] and ISO 14617^[5]). When applied, however, the proportions of an existing graphical symbol, e.g. the graphical symbols shown in Figures 4 and 5, may be modified, as long as the modified graphical symbol conveys the same semantic information as the original one.

Allowed modifications of graphical symbols may be shown, for example, in separate documentation or in application standards.

8 Variants of graphical symbols

NOTE In the context of this part of ISO 81714, variants of graphical symbols are not considered to be different graphical symbols.

When applied, different variants of a graphical symbol, satisfying different requirements with regard to flow direction and reading directions, may be needed. Due to the different geometric shape of the graphical symbol, up to two, four or eight such variants may be required.

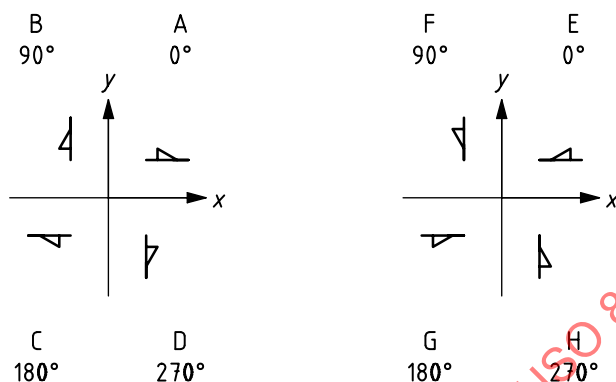
In simple cases, the variants can be obtained by rotation or creation of a mirror image. As examples, in Figures 13, 14, and 15 variant A is turned anti-clockwise by steps of 90° to variants B, C and D. Variant E is constructed by creating a mirror image of variant A about the y axis. Variant E again is turned anti-clockwise by steps of 90° to variants F, G and H.

In more complicated cases, e.g. if the graphical symbol includes text, it might be necessary to adjust the reading direction (see 6.14.3) and to shift the position of the text.

From all the possible variants shown in Figures 16 and 17, variants A, B, E and F are the preferred ones in accordance with the rules set up in this part of ISO 81714.

In the context of this part of ISO 81714, variants of graphical symbols have the same identification number but are distinguished by additional letter codes A ... H.

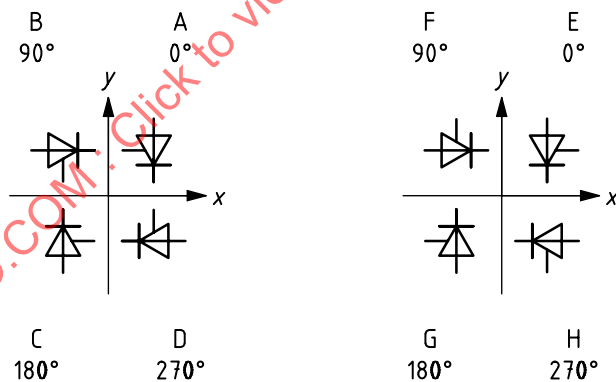
Allowed variants of graphical symbols may be shown, for example, in a separate document or in application standards.



Key

A, B, C, D, E, F, G, H variants

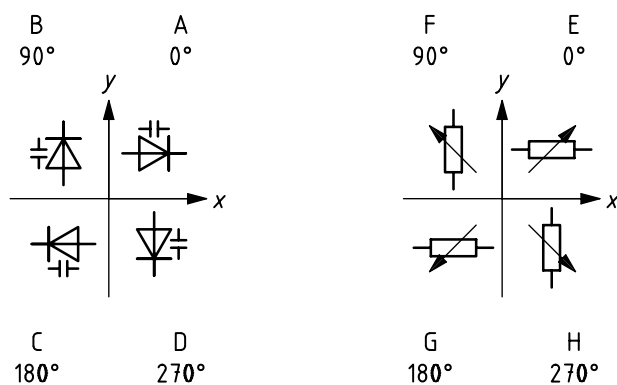
Figure 13 — Possible variants of the graphical symbol for a latch



Key

A, B, C, D, E, F, G, H variants

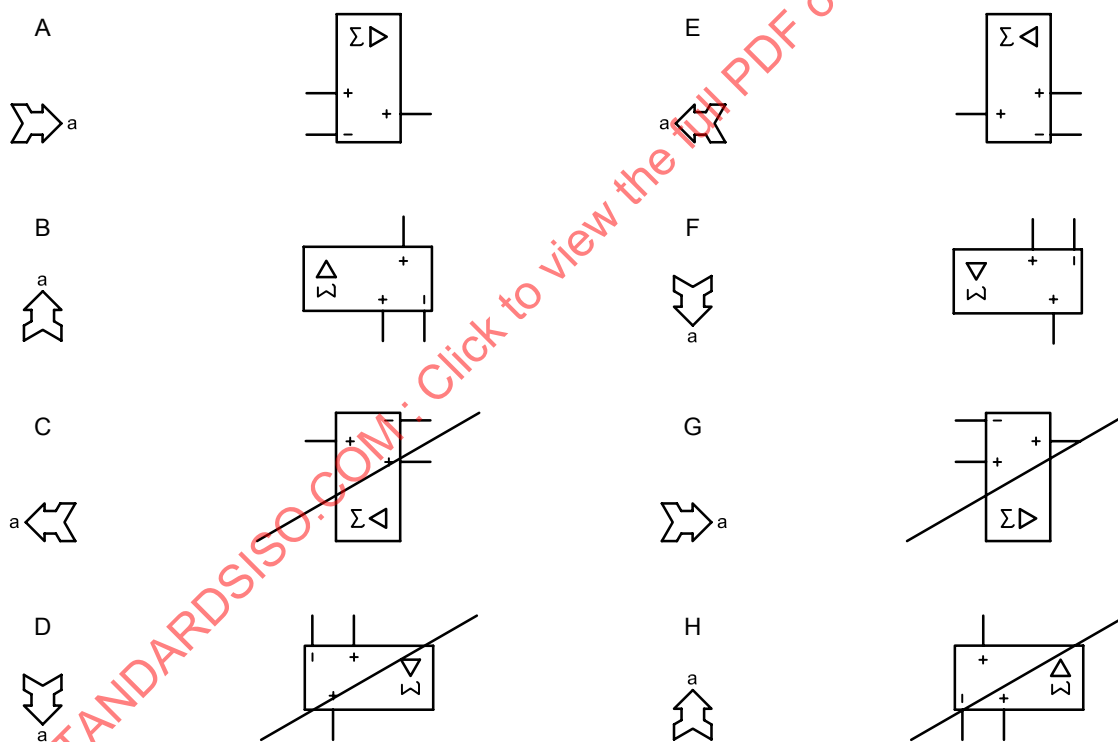
Figure 14 — Possible variants of the graphical symbol for a thyristor



Key

A, B, C, D, E, F, G, H variants

Figure 15 — Example of required modifications in different variants



Key

A, B, C, D, E, F, G, H variants

^a Arrow indicating flow direction.

Figure 16 — Example of required modifications in different variants