BS EN ISO 128-2:2022

BSI Standards Publication

Technical product documentation (TPD) — General principles of representation

Part 2: Basic conventions for lines

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee TPR/1, Technical Product Realization.

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European foreword

This document (EN ISO 128-2:2022) has been prepared by Technical Committee ISO/TC 10 "Technical product documentation" in collaboration with Technical Committee CEN/SS F01 “Technical drawings” the secretariat of which is held by CCMC.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2023, and conflicting national standards shall be withdrawn at the latest by May 2023.

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Full document details: BS EN ISO 128-2:2022

Contents

Page

Foreword ... **iv**

Introduction ... **v**

1 Scope ... **1**

2 Normative references ... **1**

3 Terms and definitions ... **2**

4 Types of lines ... **3**
- 4.1 General ... 3
- 4.2 Basic types ... 3
- 4.3 Line subtypes ... 4
- 4.4 Variations of the basic types of lines ... 4
- 4.5 Combinations of lines with the same length ... 4
  - 4.5.1 Arrangement of two or more lines parallel to each other ... 4
  - 4.5.2 Arrangement of two different types of lines ... 5
  - 4.5.3 Arrangement of two continuous lines parallel to each other with regularly recurring connecting elements between them ... 5
  - 4.5.4 Arrangement of regularly recurring geometric pictorial elements in association with continuous lines ... 5

5 Line dimensions ... **6**
- 5.1 Line width ... 6
- 5.2 Deviation in line width ... 6
- 5.3 Configuration of lines ... 6

6 Draughting of lines ... **7**
- 6.1 Spacing ... 7
- 6.2 Junctions ... 7
  - 6.2.1 Types ... 7
  - 6.2.2 Representation ... 9
- 6.3 Location of a second line ... 10
- 6.4 Hierarchy of overlapping lines ... 10

7 Colours ... **11**

8 Designation ... **11**

9 Basic conventions and applications for leader lines and reference lines ... **11**
- 9.1 Presentation of leader lines ... 11
- 9.2 Representation of reference lines ... 14
- 9.3 Indication of instructions ... 15

Annex A (informative) **Preparation of lines by CAD systems** ... **17**

Annex B (normative) **Lines in construction technical drawings** ... **30**

Annex C (informative) **Examples of application in construction technical drawings** ... **33**

Annex D (normative) **Types of lines and their application in mechanical engineering technical drawings** ... **39**

Annex E (informative) **Examples of application in mechanical engineering technical drawings** ... **43**

Annex F (normative) **Types of lines and their application on shipbuilding technical drawings** ... **55**

Annex G (informative) **Application examples of the different types of lines on shipbuilding technical drawings** ... **57**

Bibliography ... **68**

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 10, *Technical product documentation*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/SS F01, *Technical drawings*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 128-2:2020), of which it constitutes a minor revision. The changes are as follows:

— the term “line element” changed to “graphical basic element” throughout;

— in Annex C, Table C.1, the right-hand cell in the header has been changed from “Example” to “Figure no.” to be consistent with Table E.1;

— in Annex D, Table D.1, item 04.2.1, duplicate text removed;

— in Annex G, Table G.1, the third header cell from the left has been changed from “Example” to “Application” to be consistent with Table C.1 and Table E.1;

— in Annex E, Table E.1 and in Annex G, Table G.1, the right-hand cell in the header has been changed from “Figure” to “Example” to be consistent with the rest of the document;

— minor editorial changes.

A list of all parts in the ISO 128 series can be found on the ISO website.

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Introduction

This document contains generally applicable rules for the presentation of lines in all kinds of technical product documentation.

All figures in this document have been drawn in first-angle projection. It should be understood that third-angle projection or other methods could have been used equally well without prejudice to the principles established.

The application of lines within drawings of special technical fields varies considerably. Therefore, rules of application specific to technical fields are given in Annexes B to G.

Annex A provides information for the calculation of the most important basic types of non-continuous lines according to types of lines and their graphical basic elements.

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Technical product documentation (TPD) — General principles of representation —

Part 2: Basic conventions for lines

1 Scope

This document establishes the types of lines used in technical drawings (e.g. diagrams, plans or maps), their designations and their configurations, as well as general rules for the draughting of lines. In addition, this document specifies general rules for the representation of leader and reference lines and their components as well as for the arrangement of instructions on or at leader lines in technical documents. Annexes have been provided for specific information on mechanical, construction and shipbuilding technical drawings.

For the purposes of this document the term "technical drawing" is interpreted in the broadest possible sense, encompassing the total package of documentation specifying the product (workpiece, subassembly, assembly).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 128-3, *Technical product documentation (TPD) — General principles of representation — Part 3: Views, sections and cuts*

ISO 128-15, *Technical product documentation (TPD) — General principles of presentation — Part 15: Presentation of shipbuilding drawings*

ISO 129-1, *Technical product documentation (TPD) — Presentation of dimensions and tolerances — Part 1: General principles*

ISO 129-5, *Technical product documentation — Indication of dimensions and tolerances — Part 5: Dimensioning of structural metal work*

ISO 1101, *Geometrical product specifications (GPS) — Geometrical tolerancing — Tolerances of form, orientation, location and run-out*

ISO 2203, *Technical drawings — Conventional representation of gears*

ISO 2538-2, *Geometrical product specifications (GPS) — Wedges — Part 2: Dimensioning and tolerancing*

ISO 2553, *Welding and allied processes — Symbolic representation on drawings — Welded joints*

ISO 3040, *Geometrical product specifications (GPS) — Dimensioning and tolerancing — Cones*

ISO 3766, *Construction drawings — Simplified representation of concrete reinforcement*

ISO 4463-1, *Measurement methods for building — Setting-out and measurement — Part 1: Planning and organization, measuring procedures, acceptance criteria*

ISO 4463-3, *Measurement methods for building — Setting-out and measurement — Part 3: Check-lists for the procurement of surveys and measurement services*

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ISO 5261, *Technical drawings — Simplified representation of bars and profile sections*

ISO 5455, *Technical drawings — Scales*

ISO 5456-4, *Technical drawings — Projection methods — Part 4: Central projection*

ISO 5459, *Geometrical product specifications (GPS) — Geometrical tolerancing — Datums and datum systems*

ISO 6410-1, *Technical drawings — Screw threads and threaded parts — Part 1: General conventions*

ISO 6428, *Technical drawings — Requirements for microcopying*

ISO 7437, *Technical drawings — Construction drawings — General rules for execution of production drawings for prefabricated structural components*

ISO 7519, *Technical drawings — Construction drawings — General principles of presentation for general arrangement and assembly drawings*

ISO 8560, *Technical drawings — Construction drawings — Representation of modular sizes, lines and grids*

ISO 10110-1, *Optics and photonics — Preparation of drawings for optical elements and systems — Part 1: General*

ISO 10135, *Geometrical product specifications (GPS) — Drawing indications for moulded parts in technical product documentation (TPD)*

ISO 10209, *Technical product documentation — Vocabulary — Terms relating to technical drawings, product definition and related documentation*

ISO 11091, *Construction drawings — Landscape drawing practice*

ISO 12671, *Thermal spraying — Thermally sprayed coatings — Symbolic representation on drawings*

ISO 15785, *Technical drawings — Symbolic presentation and indication of adhesive, fold and pressed joints*

ISO 15787, *Technical product documentation — Heat-treated ferrous parts — Presentation and indications*

ISO 16792, *Technical product documentation — Digital product definition data practices*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 10209 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
graphical basic element
continuous graphical object with rounded or squared end shape which is represented in any way (e.g. straight, curved), which has a length and a width

Note 1 to entry: See Figure A.1.

3.2
dot
graphical basic element (3.1) having a length equal to the width, *d*

Note 1 to entry: See Figure A.2.

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3.3
line
set of one or more *graphical basic elements* (3.1) having a length of more than the width

Note 1 to entry: See Figure A.3.

3.4
technical drawing
drawing showing a technical installation, process or product with a view to clarifying its structure and enabling its construction

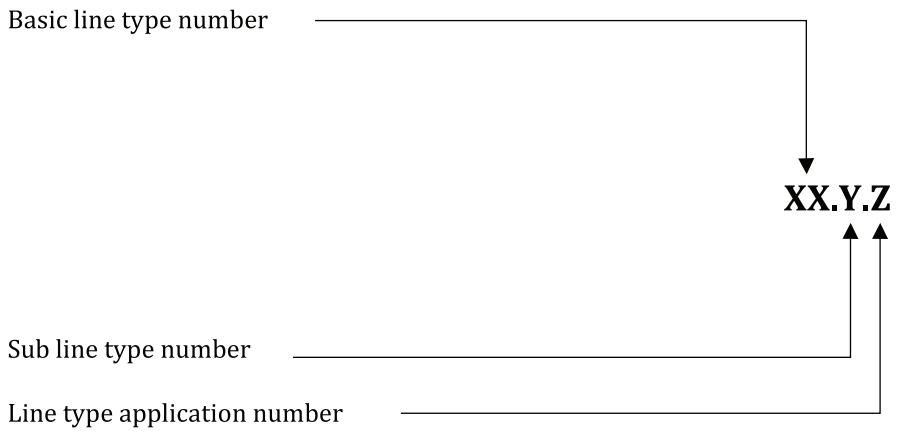
[SOURCE: ISO 5127:2017, 3.4.7.54, modified — Note 1 to entry removed.]

4 Types of lines

4.1 General

The line type designation consists of a combination of a basic line type and a subtype, depending on the line width, see 4.2.

For the purposes of this document a line type application number is used to number the application examples for the line types.



For applying line types to construction technical drawings, Annex B shall be applied. For applying line types to mechanical engineering technical drawings, Annex D shall be applied. For applying line types to ship building technical drawings, Annex F shall be applied.

4.2 Basic types

The basic line types are given in Table 1.

Table 1 — Basic line types

No.	Representation	Description
01		Continuous line
02		Dashed line
03		Dashed spaced line
04		Long-dashed dotted line
05		Long-dashed double-dotted line
06		Long-dashed triplicate-dotted line
07		Dotted line
08		Long-dashed short-dashed line

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Table 1 *(continued)*

No.	Representation	Description
09		Long-dashed double-short-dashed line
10		Dashed dotted line
11		Double-dashed dotted line
12		Dashed double-dotted line
13		Double-dashed double-dotted line
14		Dashed triplicate-dotted line
15		Double-dashed triplicate-dotted line

4.3 Line subtypes

The line subtypes are given in Table 2.

Table 2 — Line subtypes

Subtype no.[a]	Representation	Description
.1		Narrow
.2		Wide
.3		Extra-wide

[a] Line identification structure

4.4 Variations of the basic types of lines

The straight lines in Table 1 and the line widths of Table 2 can have variations as shown in Table 3.

Table 3 — Line variations

Representation	Description
	Uniform wavy continuous line
	Uniform spiral continuous line
	Uniform zigzag continuous line
	Freehand or freeform curve continuous line

NOTE This table contains only variations of the basic type of line no. 01. Variations of the basic types of no. 02 to no. 15 are possible and are presented in the same way.

4.5 Combinations of lines with the same length

4.5.1 Arrangement of two or more lines parallel to each other

For examples see Figure 1.

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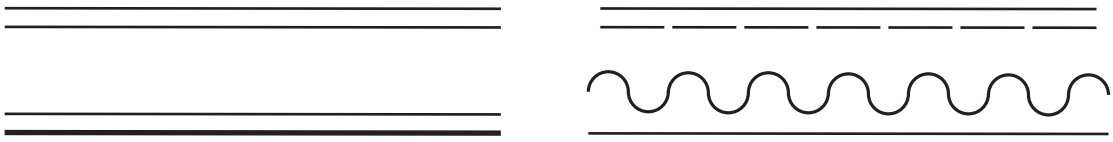

Figure 1 — Example of lines parallel to each other

4.5.2 Arrangement of two different types of lines

a) With different line widths superimposed. See Figure 2 a) and b) for examples.

a) A continuous line and a dotted line **b) A continuous line and a dashed spaced line**

Figure 2 — Example of superimposed lines

b) Arranged next to each other. See Figure 3 for an example.

Figure 3 — Two continuous narrow lines either side of a wide dashed line

4.5.3 Arrangement of two continuous lines parallel to each other with regularly recurring connecting elements between them

See Figure 4 a) and b) for examples.

a) Filled circular elements **b) Filled trapezoidal elements**

Figure 4 — Example of lines parallel to each other with regularly recurring connecting elements

4.5.4 Arrangement of regularly recurring geometric pictorial elements in association with continuous lines

a) Without interruption of a continuous line. See Figure 5 for examples.

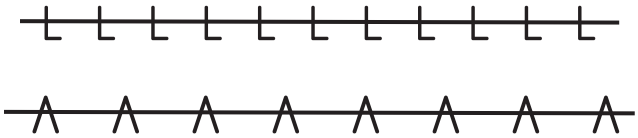

Figure 5 — Without interruption of a continuous line

b) With interruption of a continuous line. See Figure 6 for examples.

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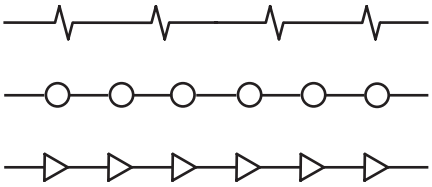

Figure 6 — With interruption of a continuous line

5 Line dimensions

5.1 Line width

The width, *d*, of all types of lines shall be one of the following depending on the type and size of the technical drawing. This series is based on a common ratio 1: $\sqrt{2}$ (≈1:1,4).

0,13 mm; 0,18 mm; 0,25 mm; 0,35 mm; 0,5 mm; 0,7 mm; 1 mm; 1,4 mm; 2 mm.

The widths of extra-wide, wide and narrow lines are in the ratio 4:2:1.

The line width of any one line shall be constant throughout the whole line.

See Annexes B, D and F for information on line widths pertaining to construction, mechanical and shipbuilding technical drawings.

5.2 Deviation in line width

Line widths can deviate from those specified in 5.1 providing that it is possible to differentiate unambiguously between two adjacent lines with different widths. If technical drawing equipment which produces constant line width is used, the deviation in line width between two such lines shall not be greater than ± 0,1*d*.

5.3 Configuration of lines

For the preparation of technical drawings, the lengths of graphical basic elements should conform to those of Table 4.

Table 4 — Lengths of graphical basic elements

Drawing element	Line type no.	Length
Dot	04 to 07 and 10 to 15	≤ *d*
Gap	02 and 04 to 15	3*d*
Short dash	08 and 09	6*d*
Dash	02, 03 and 10 to 15	12*d*
Long dash	04 to 06, 08 and 09	≈24*d*
Space	03	18*d*

NOTE The lengths shown in this table are valid for graphical basic elements with semi-circular and squared ends. In the case of graphical basic elements with semi-circular ends, the length of the graphical basic element corresponds to the distance covered by a technical pen (with a tubular tip and using India ink) from the origin up to the end of the graphical basic element. The total length of such a graphical basic element is the sum of the length shown in this table, plus *d*.

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Formulae for the calculation of some of the basic types of lines and graphical basic elements are given in Annex A. The formulae are intended to facilitate the preparation of technical drawings using computer-aided design (CAD) systems.

6 Draughting of lines

6.1 Spacing

The minimum space between parallel lines should not be less than 0,7 mm.

In certain cases when computer-aided technical drawing techniques are used, the spacing of lines on the technical drawing does not represent the actual spacing, for example for the representation of screw threads. This has to be considered when data sets are established, for example for the operation of machine tools.

6.2 Junctions

6.2.1 Types

The basic types of lines, no. 02 to no. 06 and no. 08 to no. 15, should meet at a dash to avoid ambiguity; see Figures 7 to 12.

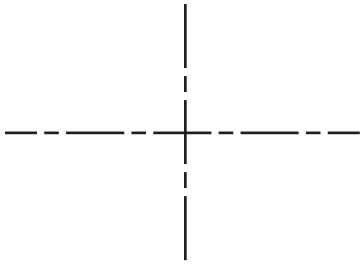

Figure 7 — Long-dashed short-dashed lines intersecting as a cross

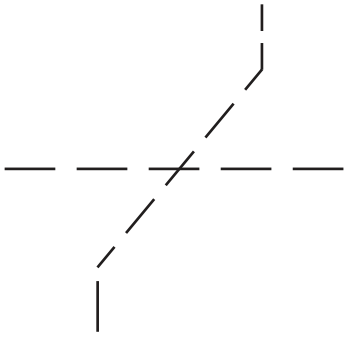

Figure 8 — Dashed lines intersecting as a cross

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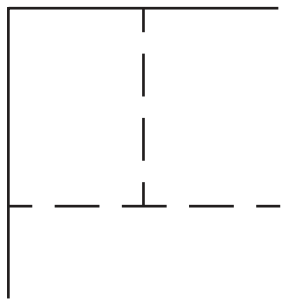

Figure 9 — Dashed lines intersecting as a partial cross

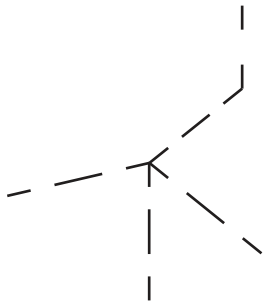

Figure 10 — Four dashed lines meeting at an intersection

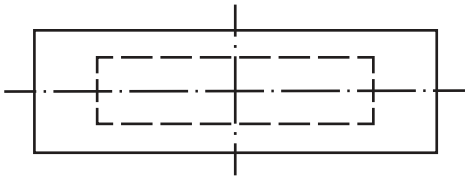

Figure 11 — Dash dotted lines intersecting as a cross and dashed lines meeting at corners

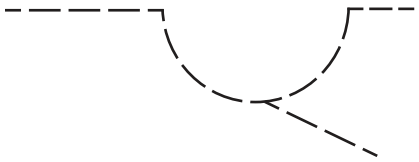

Figure 12 — Dashed lines meeting at corners and at intersection

Lines of basic type no. 07 should meet at a dot to avoid ambiguity, see Figure 13.

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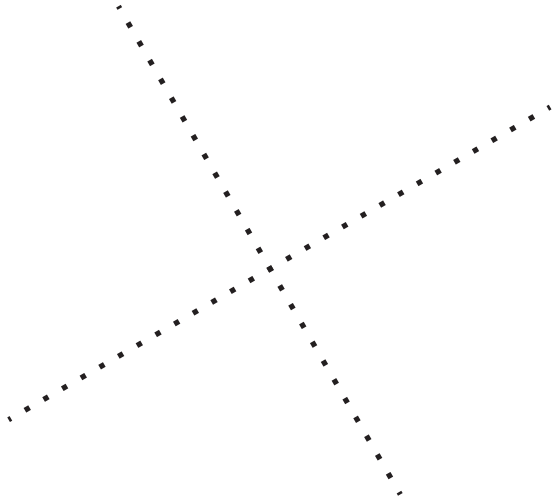

Figure 13 — Dotted lines intersecting at a dot

6.2.2 Representation

Techniques for applying the recommendations of 6.2.1 are to start the lines at the junction (see Figure 14) or by using a complete, or partial, cross or Y (see Figures 15 and 16).

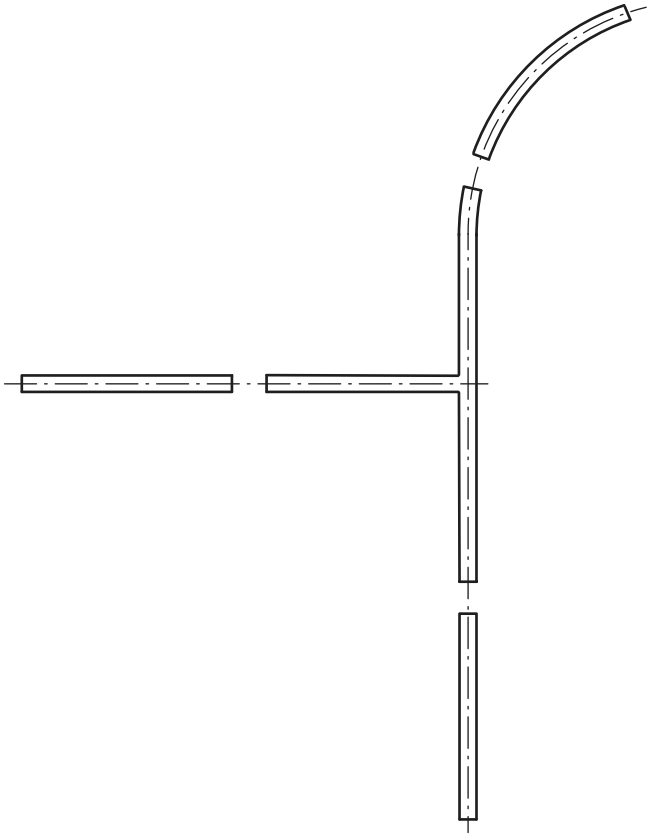

Figure 14 — Partial cross intersection

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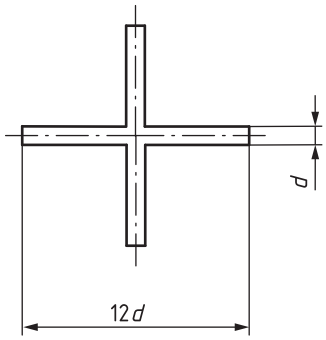

Figure 15 — Cross intersection

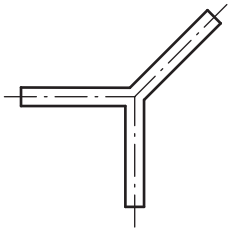

Figure 16 — Y intersection

6.3 Location of a second line

Two different ways of presenting two parallel lines are shown in Figures 17 and 18.

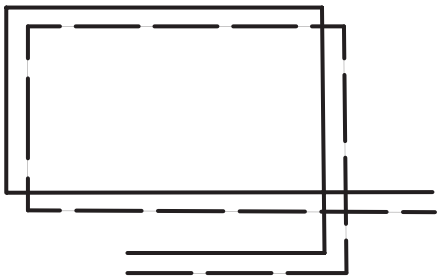

Figure 17 — Example of parallel lines with solid line above dashed line

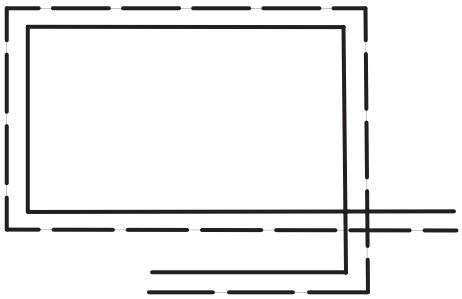

Figure 18 — Example of parallel lines with dashed line above solid line

6.4 Hierarchy of overlapping lines

The rules of overlapping types of lines are defined in Annex D.

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7 Colours

Lines shall be drawn in black or white depending on the colour of the background. By default, lines are black on a white background. Other standardized colours may also be used for technical drawing standardized lines. In this case, the meaning of the colours shall be explained.

8 Designation

The designation of the basic types of lines shall comprise the following elements in the order given, with spaces between the elements:

a) "Line";

b) reference to this document;

c) dash separator;

d) the number of the basic type in accordance with Table 1;

e) the multiplication sign "×";

f) the line width in accordance with 5.1;

g) forward slash (when the colour is indicated);

h) colour (when indicated).

EXAMPLES

Designation of a line of type no. 03 (03), line width 0,25 mm (0,25):

Line ISO 128-2 - 03 × 0,25

Designation of a line of type no. 05 (05), line width 0,13 mm (0,13) and blue in colour:

Line ISO 128-2 - 05 × 0,13/blue

9 Basic conventions and applications for leader lines and reference lines

9.1 Presentation of leader lines

Leader lines are executed as continuous narrow lines (type 01.1) in accordance with this document. They are drawn at an angle to the relevant representation and/or the frame limiting the drawing sheet, and not parallel to nearby lines, such as hatching lines. The inclination to the relevant lines shall be > 15°. See Figures 19 to 31.

Leader lines may be drawn with sharp kinks (see Figure 23), and two or more leader lines may start from the same point (see Figures 20, 23, 25, 26 and 29). They should not cross other leader lines (see Figure 23) except when the leader line starts from the same point and is colinear (see Figure 25, 26 and 29), reference lines or indications, such as graphical symbols or dimensional values.

Leader lines shall terminate at the end which touches the features as follows:

— with a closed and filled arrowhead or a closed arrowhead as per ISO 129-1 if the leader line ends at lines which represent outlines or edges of parts, piping or cables in plans, charts or diagrams; arrowheads are also drawn at crossing points of these lines with other lines, for example lines of symmetry (see the examples given in Figures 19 to 25);

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If several parallel lines have to be designated, oblique strokes instead of arrowheads are permitted (see IEC 61082-1). See the example given in Figure 26.

— with a dot (d = 5 × line width) if the leader line ends on the surface of an object (see the examples given in Figures 27 to 29);

— without any termination if the leader line ends at another line, for example dimension line or line of symmetry (see the examples given in Figures 30 and 31).

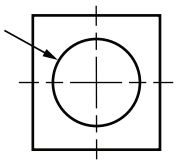

Figure 19 — Example of a leader line terminating at the edge of a diameter

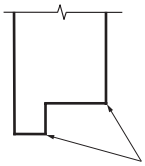

Figure 20 — Example of leader lines starting at the same point and terminating at part edges

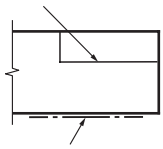

Figure 21 — Example of leader lines terminating at outlines

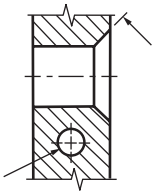

Figure 22 — Example of leader lines not overlapping cross section lines

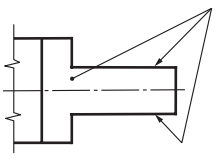

Figure 23 — Example of a leader line with a sharp kink

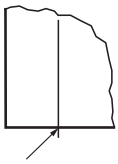

Figure 24 — Example of a leader line terminating at the crossing point of two lines

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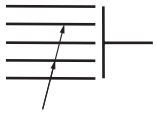

Figure 25 — Example of colinear leader lines starting from the same point and terminating with arrows

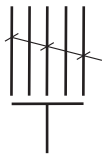

Figure 26 — Example of a colinear leader lines starting from the same point and terminating with oblique strokes

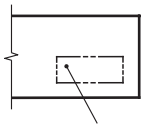

Figure 27 — Example of a leader line terminating with a dot to a surface area

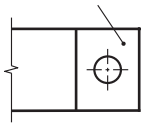

Figure 28 — Example of a leader line terminating with a dot to a surface

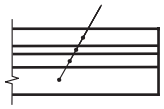

Figure 29 — Example of colinear leader lines starting from the same point and terminating with dots

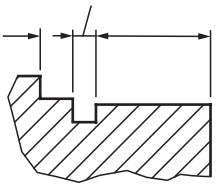

Figure 30 — Example of a leader line ending at a dimension line without any termination mark

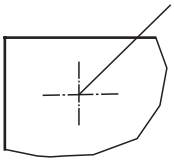

Figure 31 — Example of a leader line without any termination mark

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9.2 Representation of reference lines

Reference lines are continuous narrow lines (type 01.1) in accordance with Clause 4. A reference line can be added to each leader line or dimension line. It is drawn in one of the reading directions of the technical drawing.

The reference line shall be drawn either:

— with a fixed length, i.e. 20 × line width of the reference line (see the examples given in Figures 33 and 34); or

— with a length adapted to the length of the indicated instructions (see the examples given in Figures 32, 35, 39 and 40).

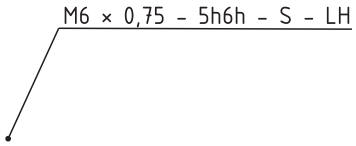

Figure 32 — Example of a reference line adapted to the thread callout length

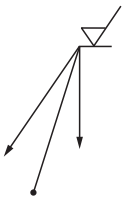

Figure 33 — Example of a reference line with a fixed length for a surface finish

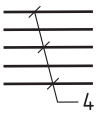

Figure 34 — Example of a reference line with a fixed length for a dimension

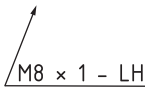

Figure 35 — Example of a reference line adapted to the thread callout length

In particular cases of application, the reference line has to be drawn (see the example given in Figure 33).

However, the reference line can be omitted if the leader line is drawn in one of the reading directions of the technical drawing, if the indicated instructions are written in the same direction (see the example given in Figure 36), and in all other cases in which this line is not applicable (see the examples given in Figures 30, 37 and 38).

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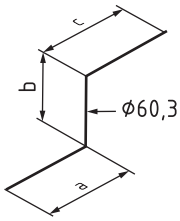

Figure 36 — Example of a reference line for dimension being omitted

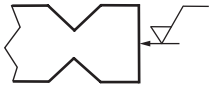

Figure 37 — Example of a reference line for a surface finish being omitted

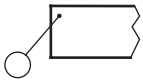

Figure 38 — Example of an omitted reference line

9.3 Indication of instructions

The instructions belonging to the leader lines, dimension lines and reference lines shall be indicated as follows:

— above the reference line (see the example given in Figures 32, 35, 39 and 40 and in Annex E);

— centrically at the end of the leader, dimension or reference line (see the example given in Figure 34 and 36) in one of the reading directions of the drawing; or

— within graphical symbols according to the valid International Standards (see the examples given in Annex E).

Taking into account legibility, the requirements in ISO 6428 shall be followed and the instructions shall be written at a distance of twice the line width of the reference line above the reference line. They shall not be drawn within the reference line and they shall not touch it.

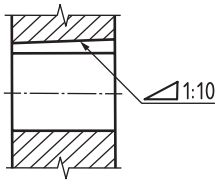

Figure 39 — Example of instructions above a reference line

If individual layers or assembled parts of an object are designated with one leader line, the order of the indications shall correspond with the order of the layers or the parts (see the example given in Figure 40).

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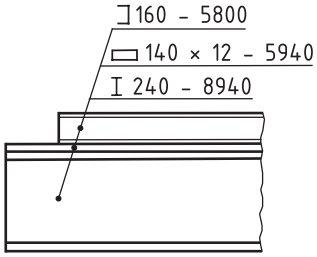

Figure 40 — Example of assembled parts of an object designated with one leader line

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