INTERNATIONAL STANDARD

ISO 128-2

Second edition
2022-10

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

Part 2: Basic conventions for lines

Documentation technique de produits (TPD) — Principes généraux de représentation —

Partie 2: Conventions de base pour les traits

Reference number
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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.

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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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.

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*

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.

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

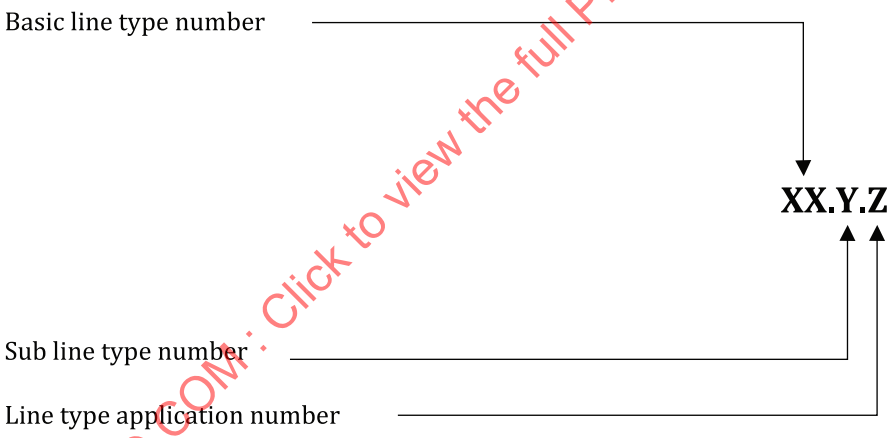
[SOURCE: ISO 5127:2017, 3.4.7.54, modified — Note 1 to entry removed.]

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

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.

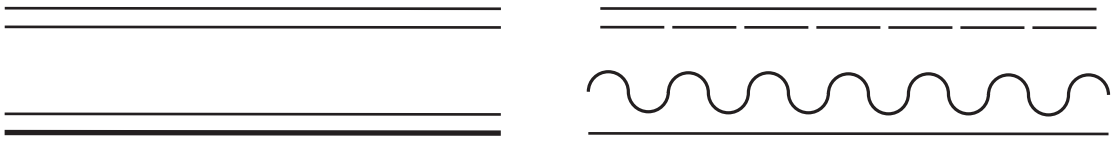


Figure 1 — Example of lines parallel to each other

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.

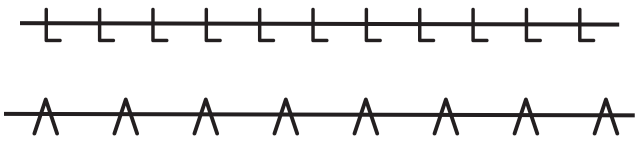


Figure 5 — Without interruption of a continuous line

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

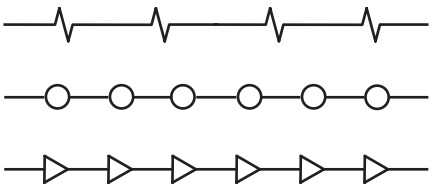


Figure 6 — With interruption of a continuous line

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*.		

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.

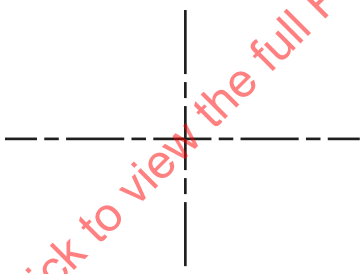


Figure 7 — Long-dashed short-dashed lines intersecting as a cross

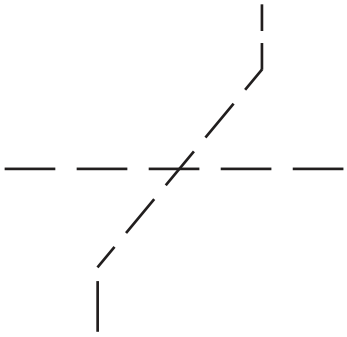


Figure 8 — Dashed lines intersecting as a cross

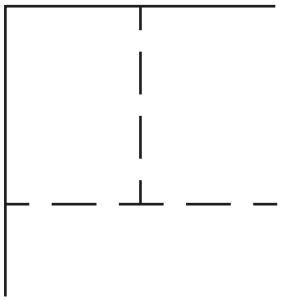


Figure 9 — Dashed lines intersecting as a partial cross

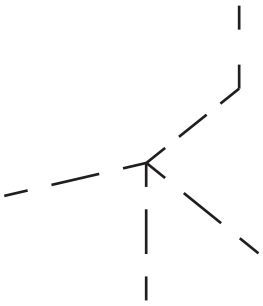


Figure 10 — Four dashed lines meeting at an intersection

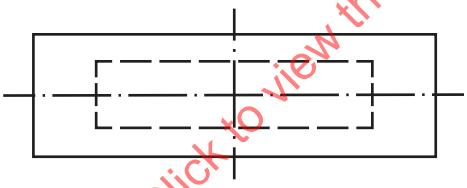


Figure 11 — Dash dotted lines intersecting as a cross and dashed lines meeting at corners

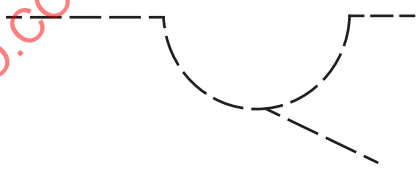


Figure 12 — Dashed lines meeting at corners and at intersection

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

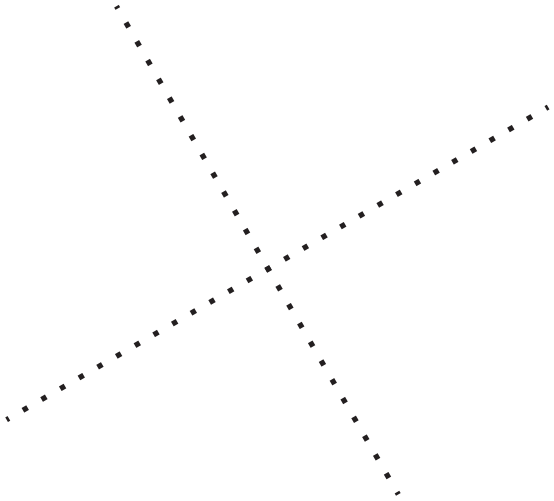


Figure 13 — Dotted lines intersecting at a dot

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).

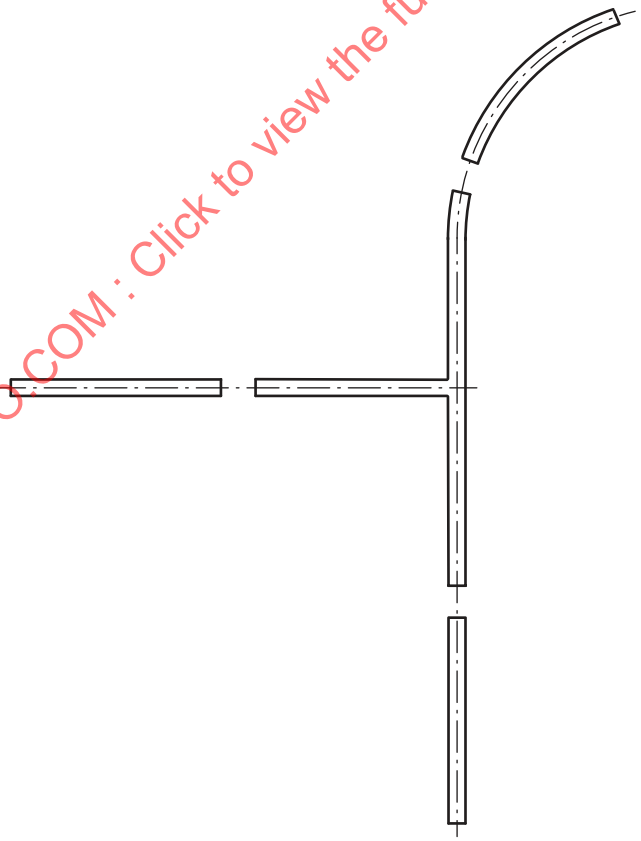


Figure 14 — Partial cross intersection

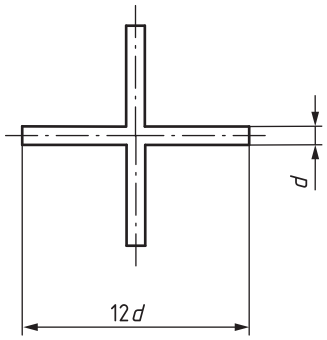


Figure 15 — Cross intersection

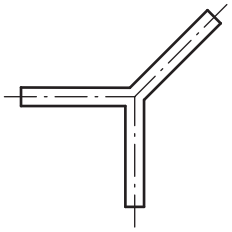


Figure 16 — Y intersection

6.3 Location of a second line

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

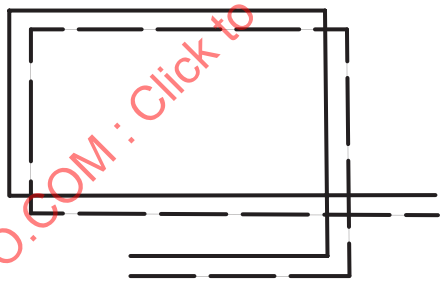


Figure 17 — Example of parallel lines with solid line above dashed line

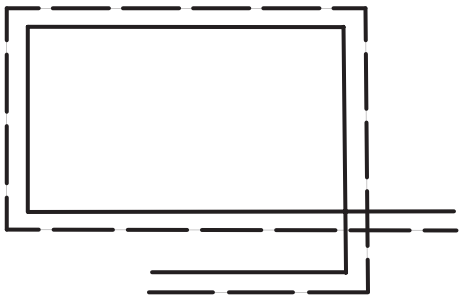


Figure 18 — Example of parallel lines with dashed line above solid line

6.4 Hierarchy of overlapping lines

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

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);

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).

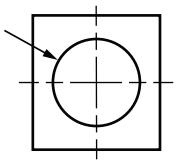


Figure 19 — Example of a leader line terminating at the edge of a diameter

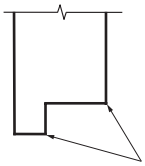


Figure 20 — Example of leader lines starting at the same point and terminating at part edges

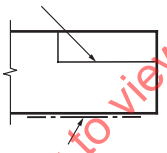


Figure 21 — Example of leader lines terminating at outlines

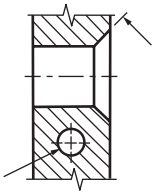


Figure 22 — Example of leader lines not overlapping cross section lines

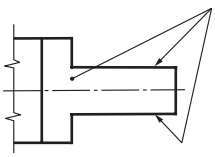


Figure 23 — Example of a leader line with a sharp kink

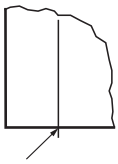


Figure 24 — Example of a leader line terminating at the crossing point of two lines

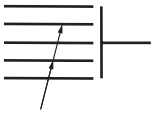


Figure 25 — Example of colinear leader lines starting from the same point and terminating with arrows

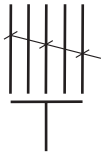


Figure 26 — Example of a colinear leader lines starting from the same point and terminating with oblique strokes

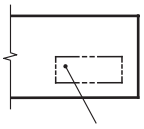


Figure 27 — Example of a leader line terminating with a dot to a surface area

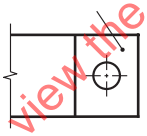


Figure 28 — Example of a leader line terminating with a dot to a surface

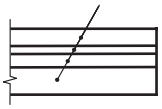


Figure 29 — Example of colinear leader lines starting from the same point and terminating with dots

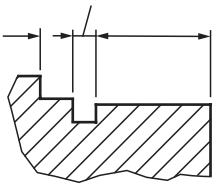


Figure 30 — Example of a leader line ending at a dimension line without any termination mark

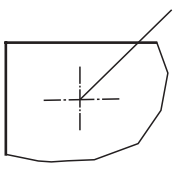


Figure 31 — Example of a leader line without any termination mark

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).

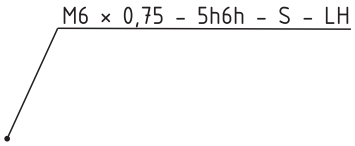


Figure 32 — Example of a reference line adapted to the thread callout length

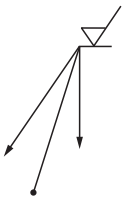


Figure 33 — Example of a reference line with a fixed length for a surface finish

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

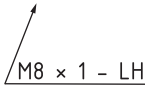


Figure 35 — Example of a reference line adapted to the thread callout length

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).

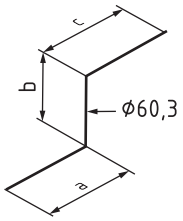


Figure 36 — Example of a reference line for dimension being omitted

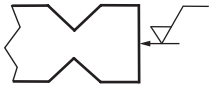


Figure 37 — Example of a reference line for a surface finish being omitted

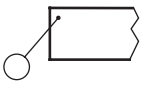


Figure 38 — Example of an omitted reference line

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.

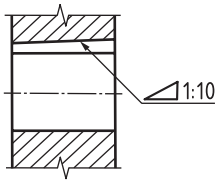


Figure 39 — Example of instructions above a reference line

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).

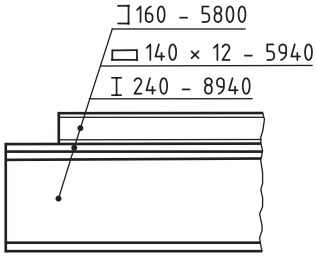


Figure 40 — Example of assembled parts of an object designated with one leader line

Annex A
(informative)

Preparation of lines by CAD systems

A.1 Calculation of graphical basic elements

This annex specifies procedures for the calculation of the most important basic types of non-continuous line types and their graphical basic elements.

A.2 Graphical basic element

See Figure A.1 for an example of a configuration of a graphical basic element.

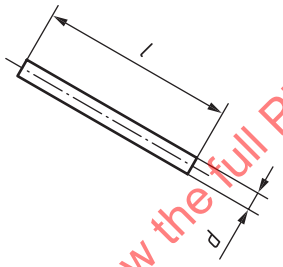


Figure A.1 — Configuration of a graphical basic element

A.3 Dot

See Figure A.2 for the configuration of a dot.

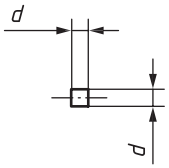


Figure A.2 — Configuration of a dot

A.4 Line

See Figure A.3 for the configuration of a line.

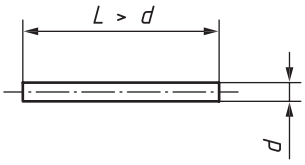


Figure A.3 — Configuration of a line

A.5 Line type no. 02 (dashed line)

See Figure A.4 for the configuration of this type of line.

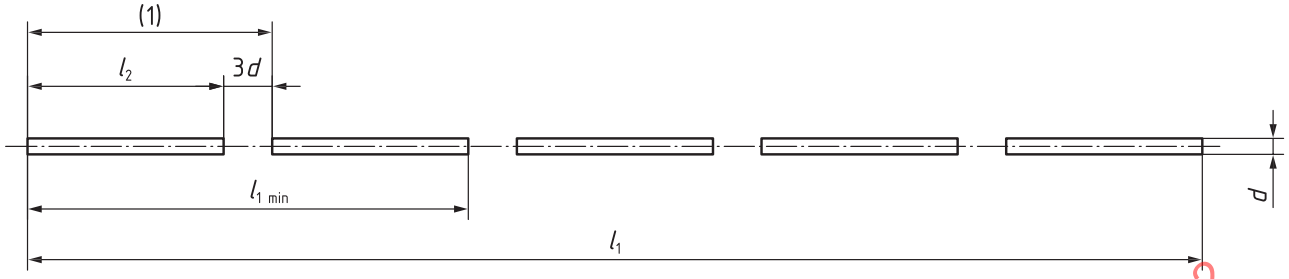


Figure A.4 — Configuration of line type no. 02 (dashed line)

EXAMPLE See Figure A.5.

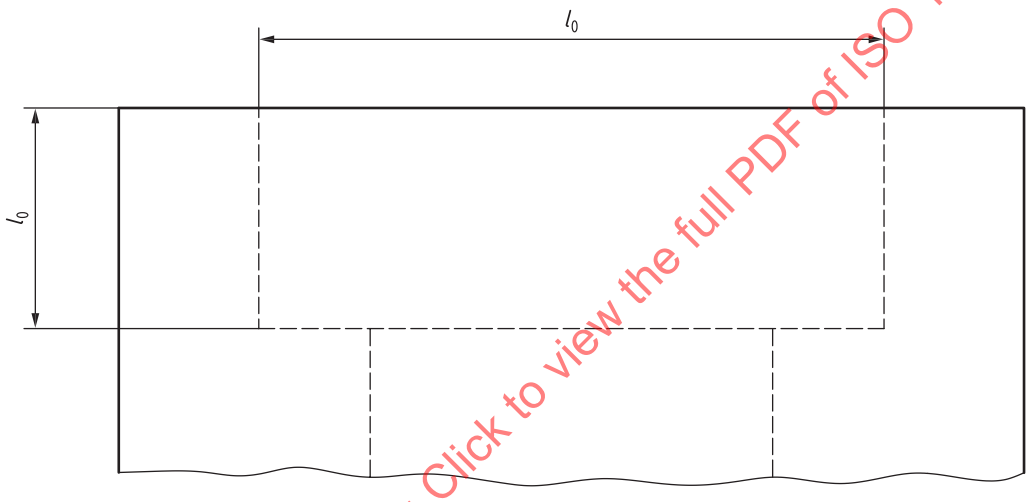


Figure A.5 — Example of line type no. 02 (dashed line)

Formulae:

a) Length of the line: $l_1 = l_0$

b) Number of line segments within the line: $n = \dfrac{l_1 - 12d}{15d}$

c) Length of the dashes: $l_2 = \dfrac{l_1 - 3dn}{n+1}$

d) Minimum length of this line: $l_{1\min} = l_{0\min} = 27d$

If dashed lines with a length less than $l_1 = 27d$ have to be drawn, a larger scale from ISO 5455 shall be used (i.e. the elements are drawn at a larger scale).

This line can be drawn with a constant length of dashes ($12d$). In this case one end of the line may be a shorter or longer dash.

Number of line segments shall be rounded to an integer.

EXAMPLE

$l_1 = 125$ $d = 0{,}35$

$$n = \frac{125 - 4{,}2}{5{,}25} = 23{,}01 \triangleq 23$$

$$l_2 = \frac{125 - 24{,}15}{24} = 4{,}202$$

Interpretation of the result: A dashed line of length 125 mm and line width 0,35 mm consists of 23 line segments of length 5,252 mm (4,202 mm + 1,050 mm) and one dash of length 4,202 mm.

A.6 Line type no. 04 (long-dashed dotted line)

See Figure A.6 for the configuration of this type of line.

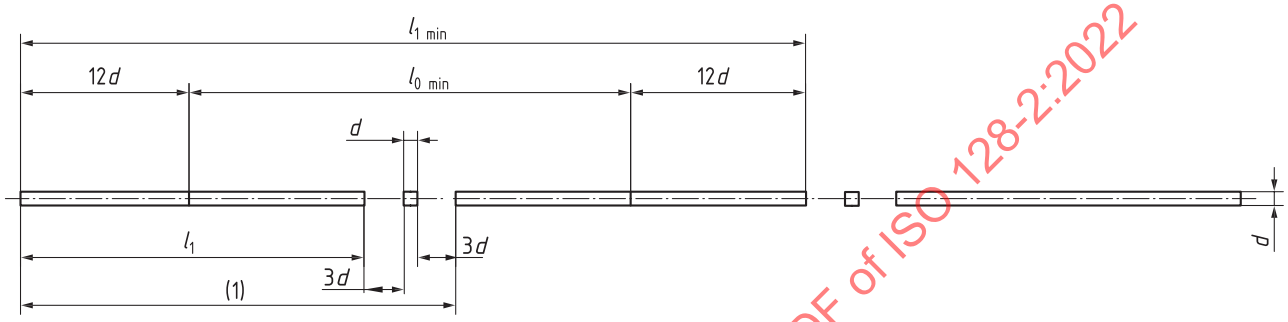


Figure A.6 — Configuration of line type no. 04 (long-dashed dotted line)

EXAMPLE See Figure A.7.

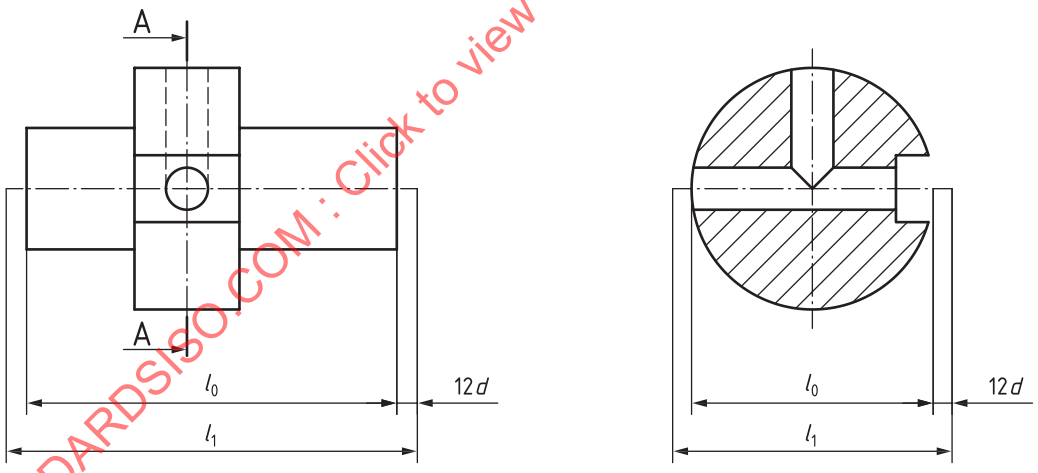


Figure A.7 — Example of line type no. 04 (long-dashed dotted line)

Formulae:

a) Length of the line: $l_1 = l_0 + 24d$
(line extended over the outlines at both sides)

b) Number of line segments within the line: $n = \frac{l_1 - 24d}{30{,}5d}$

c) Length of the long dashes: $l_3 = \frac{l_1 - 6{,}5dn}{n+1}$

d) Minimum length of this line: $l_{1\min} = 54{,}5d$

Lines shorter than l_1 = 54,5d shall be drawn as continuous lines. In order to conform with the requirements of Clause 6, the length of the long dashes of this line may be decreased or increased.

Number of line segments shall be rounded to an integer.

EXAMPLE

l_0 = 125 d = 0,25

l_1 = 125 + 6 = 131

$$n = \frac{131-6}{7,625} = 16,393 \hat{=} 16$$

$$l_3 = \frac{131-26,00}{17} = 6,176$$

Interpretation of the result: a long-dashed dotted line of length 131 mm and line width 0,25 mm consists of 16 line segments of length 7,801 mm (6,176 mm + 0,750 mm + 0,125 mm + 0,750 mm) and one long dash of length 6,176 mm.

A.7 Line type no. 05 (long-dashed double-dotted line)

See Figure A.8 for the configuration of this type of line.

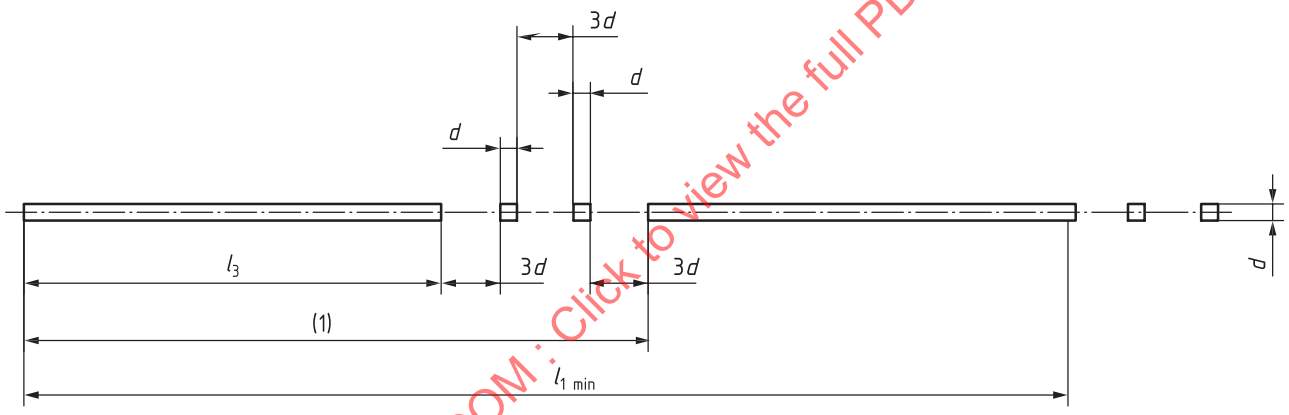


Figure A.8 — Configuration of line type no. 05 (long-dashed double-dotted line)

EXAMPLE See Figure A.9.

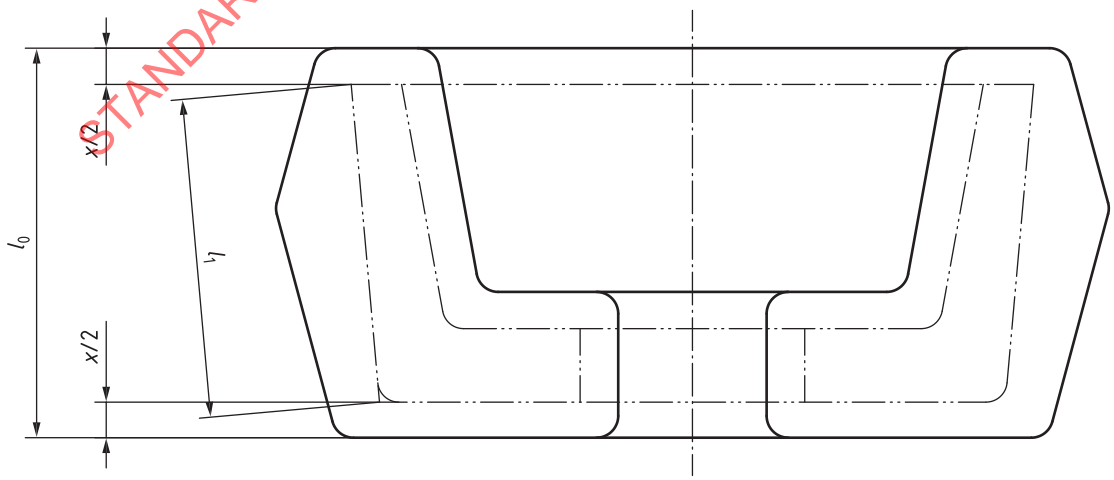


Figure A.9 — Example of line type no. 05 (long-dashed double-dotted line)

Formulae:

a) Length of the line: $l_1 \approx l_0 - x$

b) Number of line segments within the line: $n = \frac{l_1 - 24d}{34d}$

c) Length of the long dashes: $l_3 = \frac{l_1 - 10dn}{n+1}$

d) Minimum length of this line: $l_{1\min} = 58d$

Lines shorter than $l_1 = 58d$ shall be drawn at a larger scale, in accordance with ISO 5455.

It is permissible to draw the long dashes with a change in direction, see Figure A.10.

Number of line segments shall be rounded to an integer.

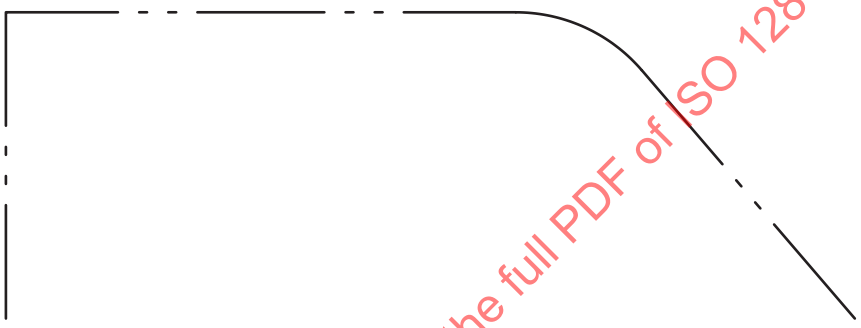


Figure A.10 — Long-dashed double-dotted line with a change in direction

In order to conform with the requirements of Clause 6, the length of the long dashes of this line may be increased or decreased.

EXAMPLE

$l_0 = 128$ $d = 0{,}35$ $\frac{x}{2} = 1{,}5$

$l_1 = 128 - 3 = 125$

$n = \frac{125 - 8{,}4}{11{,}9} = 9{,}798 \approx 10$

$l_3 = \frac{125 - 35}{11} = 8{,}182$

A.8 Line type no. 07 (dotted line)

See Figure A.11 for the configuration of this type of line.

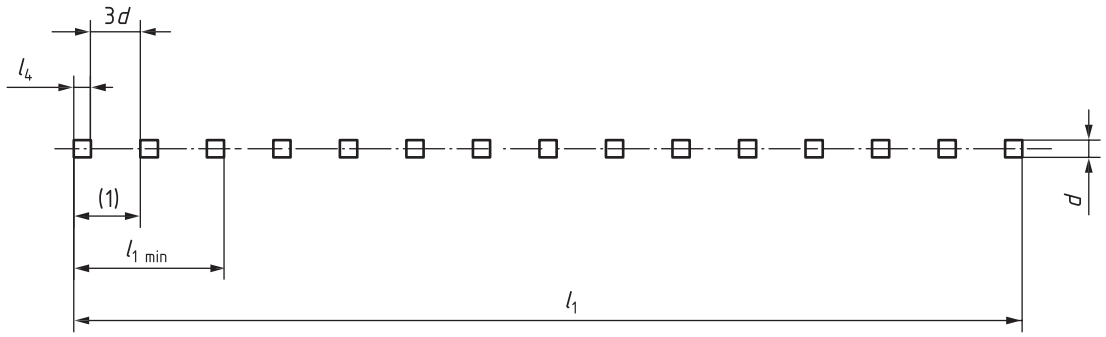


Figure A.11 — Configuration of line type no. 07 (dotted line)

EXAMPLE See Figure A.12.

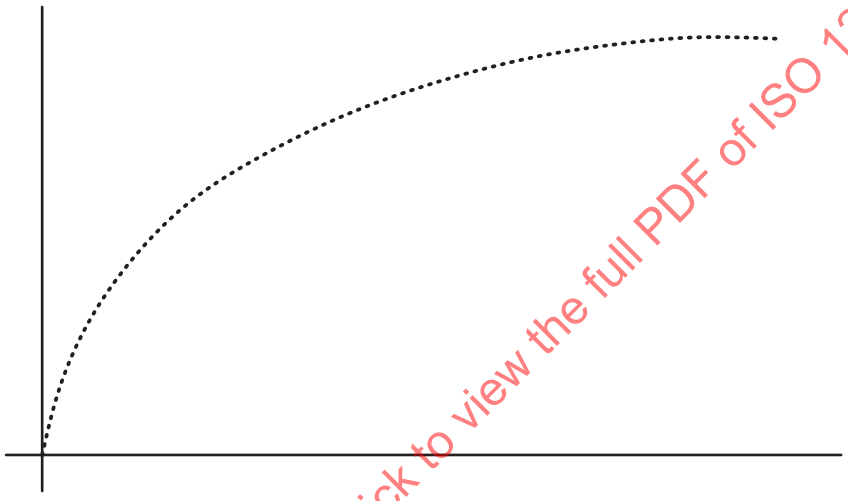


Figure A.12 — Example of line type no. 07 (dotted line)

Formulae:

a) Length of the line: $l_1 = l_0$

b) Number of line segments within the line: $n = \frac{l_1 - d}{2{,}5d}$

c) Length of the dots: $l_4 = \frac{l_1 - 1{,}5dn}{n+1}$

d) Minimum length of this line: $l_{1\min} = 9d$

Number of line segments shall be rounded to an integer.

EXAMPLE

$l_1 = 125 \qquad d = 1$

$n = \frac{125-1}{2{,}5} = 49{,}6 \triangleq 50$

$l_4 = \frac{125-75}{51} = 0{,}98$

A.9 Line type no. 08 (long-dashed short-dashed line)

See Figure A.13 for the configuration of this type of line.

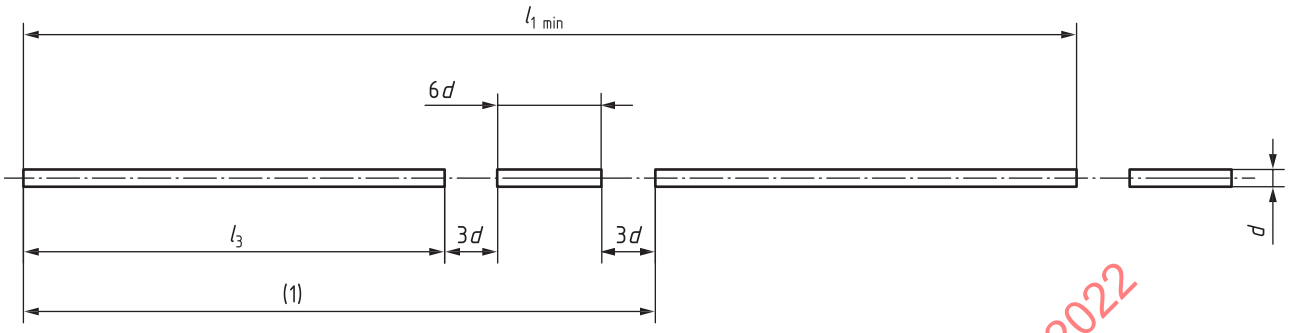


Figure A.13 — Configuration of line type no. 08 (long-dashed short-dashed line)

The conditions for this line type are the same as those for type no. 04 but the formulae are slightly modified as follows:

a) Length of the line: $l_1 = l_0$

b) Number of line segments within the line: $n = \frac{l_1 - 24d}{32d}$

c) Length of the long dashes: $l_3 = \frac{l_1 - 12dn}{n+1}$

d) Lengths of the short dashes: $6d$

e) Minimum length of this line: $l_{1\,min} = 60d$

Number of line segments shall be rounded to an integer.

EXAMPLE

$l_1 = 125 \qquad d = 0{,}5$

$n = \frac{125-12}{16} = 7{,}063 \triangleq 7$

$l_3 = \frac{125-42}{8} = 10{,}375$

A.10 Line type no. 09 (long-dashed double-short-dashed line)

See Figure A.14 for the configuration of this type of line.

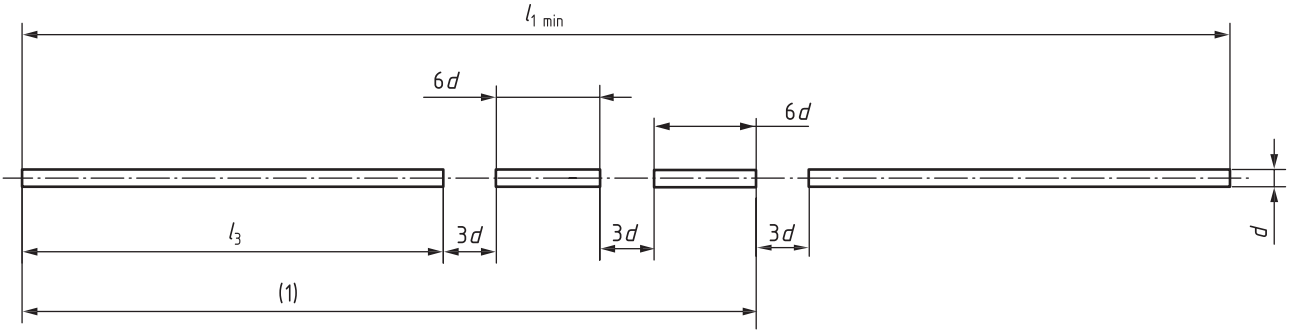


Figure A.14 — Configuration of line type no. 09 (long-dashed double-short-dashed line)

The conditions for this line type are similar to those for type no. 05 and the formulae b), c) and d) are slightly modified as follows:

a) Length of the line: $l_1 = l_0$

b) Number of line segments within the line $n = \dfrac{l_1 - 24d}{45d}$

c) Length of the long dashes: $l_3 = \dfrac{l_1 - 21dn}{n+1}$

d) Length of the short dashes: $6d$

e) Minimum length of this line: $l_{1\,\mathrm{min}} = 69d$

Number of line segments shall be rounded to an integer.

EXAMPLE

$l_1 = 125 \qquad d = 0{,}25$

$$n = \frac{125 - 6}{11{,}25} = 10{,}578 \triangleq 11$$

$$l_3 = \frac{125 - 57{,}75}{12} = 5{,}604$$

A.11 Examples of combinations of basic types of line

A.11.1 Two types of lines superimposed

See Figure A.15 for the configuration of this type of line.

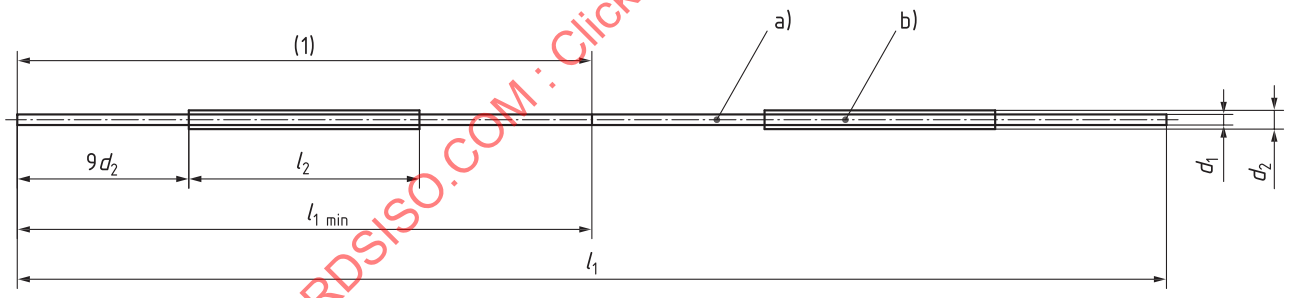


Figure A.15 — Configuration of two types of lines superimposed

EXAMPLE See Figure A.16.

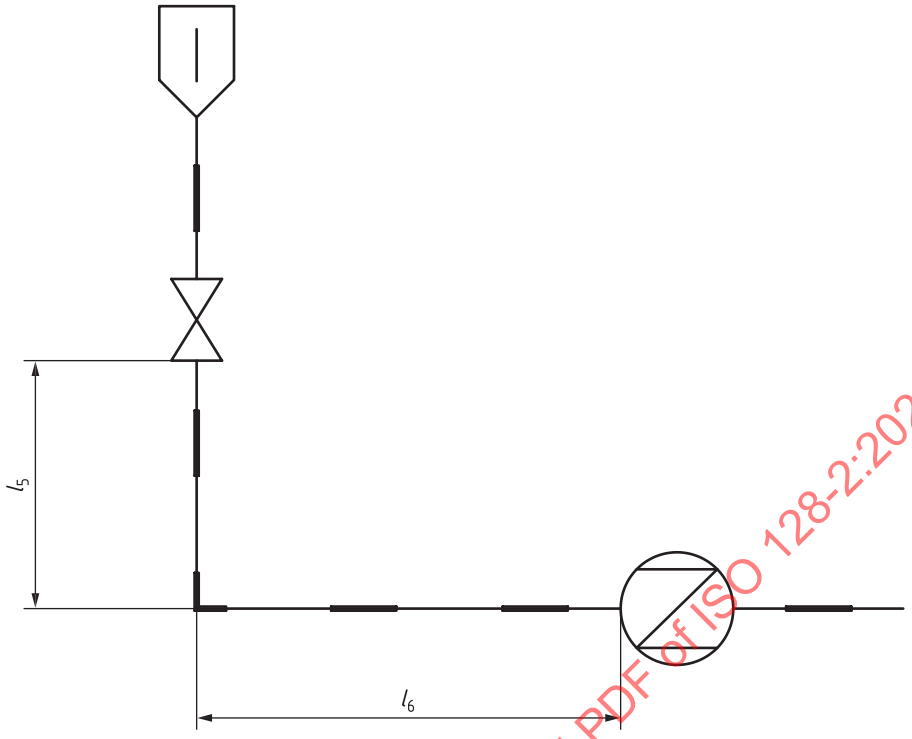


Figure A.16 — Example of two types of lines superimposed

Formulae:

a) Length of the line: $l_1 = l_5 + l_6$

b) Number of line segments within the line: $n = \frac{l_1}{30d_2}$

c) Length of the dashes: $l_2 = \frac{l_1 - 18d_2 n}{n}$

d) Minimum length of this line: $l_{1\min} = 30d_2$

Number of line segments shall be rounded to an integer.

EXAMPLE

$l_1 = 125$ $d_1 = 0{,}25$ $d_2 = 0{,}5$

$n = \frac{125}{15} = 8{,}333 \triangleq 8$

$l_2 = \frac{125-72}{8} = 6{,}625$

Interpretation of the result: this line consists of a continuous line 125 mm long and 0,25 mm wide, as well as a dashed spaced line of width 0,5 mm and eight dashes of length 6,625 mm, spaced 9 mm apart ($18d_2$, see Table 4). The ends are 45 mm in length ($9d_2$).

A.11.2 Line with zigzags

See Figure A.17 for the configuration of this type of line.

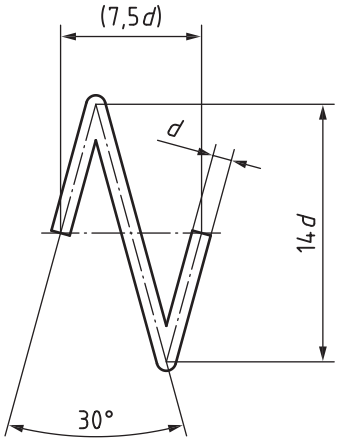


Figure A.17 — Configuration of line with zigzags

EXAMPLES See Figures A.18 and A.19.

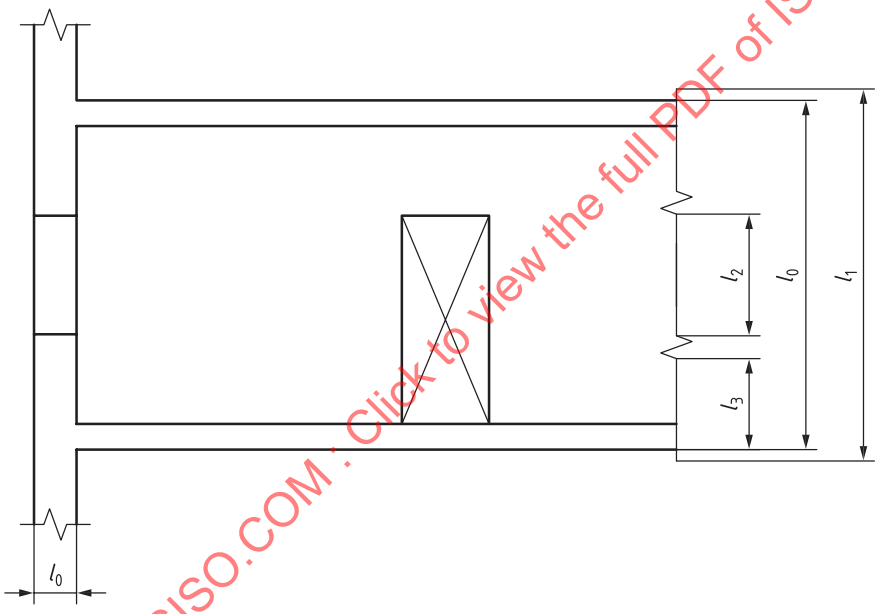


Figure A.18 — Example of line with zigzags

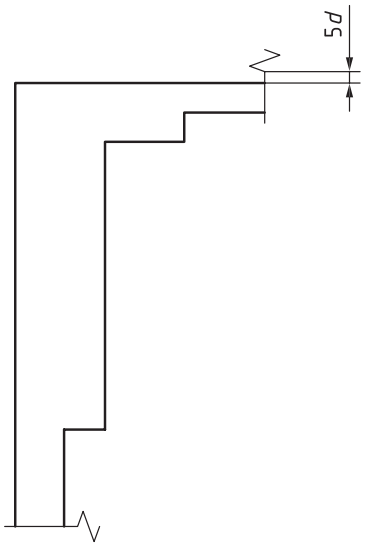


Figure A.19 — Example of line with zigzags

Formulae:

a) Length of the line: $l_1 = l_0 + 10d$

b) Number of zigzags within the line: $n = \frac{l_1}{80} + 1$

c) Length of the dashes between zigzags: $l_2 = \frac{l_1}{n} - 7{,}5d$

d) Length of the dashes at the ends of the line:

— if two or more zigzags: $l_3 = \frac{l_2}{2}$

— if one zigzag: $l_3 = \frac{l_1 - 7{,}5d}{2}$

If $l_0 \leq 10d$, the zigzag shall be arranged as shown in Figure A.19.

Number of zigzags within the line shall be rounded to an integer, $l_1 < 40$ makes $n = 1$.

EXAMPLE

$l_0 = 125$ $d = 0{,}25$

$l_1 = 125 + 2{,}5 = 127{,}5$

$n = \frac{127{,}5}{80} + 1 = 2{,}594 \triangleq 3$

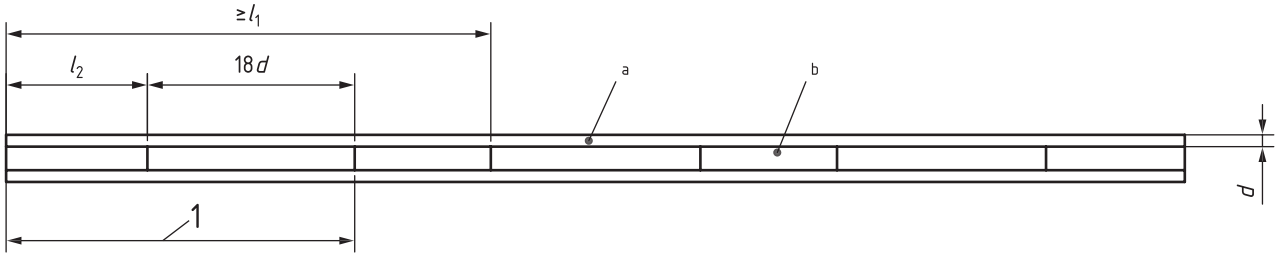
$l_2 = \frac{127{,}5}{3} - (7{,}5 \times 0{,}25) = 40{,}625$

$l_3 = \frac{40{,}625}{2} = 20{,}313$

Interpretation of the result: a line with zigzags with a length of 127,5 mm and a line width of 0,25 mm is drawn with three zigzags. The distance between the zigzags is 40,625 mm and the length of the dashes at the ends is 20,313 mm.

A.11.3 “Railway” line

See Figure A.20 for the configuration of this type of line.



Key

1 line segment

a Continuous line no. 01.

b Dashed spaced line no. 03.

Figure A.20 — Configuration of “railway” line

EXAMPLE See Figure A.21.

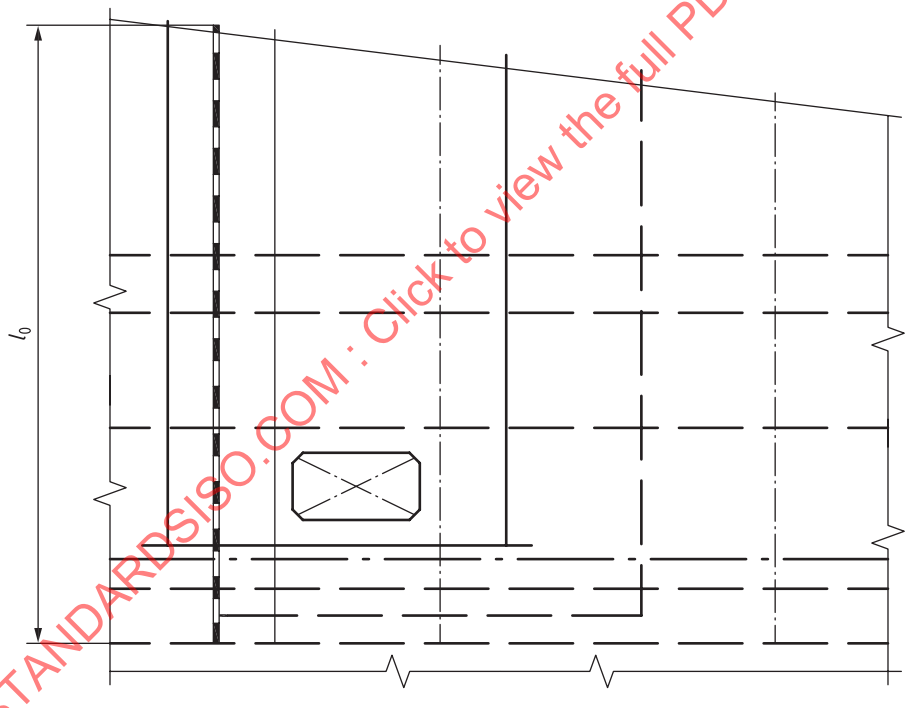


Figure A.21 — Example of “railway” line

Formulae:

a) Length of the line: $l_1 = l_0$

b) Number of line segments within the line: $n = \frac{l_1 - 12d}{30d}$

c) Length of the dashes: $l_2 = \frac{l_1 - 18dn}{n+1}$

d) Minimum length of this line: $l_{1\min} = 42d$

Number of line segments shall be rounded to an integer.

EXAMPLE

$l_1 = 125$ $d = 0,35$

$$n = \frac{125 - 4,2}{10,5} = 11,505 \hat{=} 12$$

$$l_2 = \frac{125 - 75,60}{12 + 1} = 3,800$$

Interpretation of the results: a “railway” line of length 125 mm and line width 1,4 mm (4 × 0,35 mm) consists of 12 complete line segments of length 10,100 mm (3,800 mm + 6,300 mm) and one dash of length 3,800 mm.

Annex B
(normative)

Lines in construction technical drawings

B.1 Field of application

This annex specifies types of lines and their application in construction technical drawings.

B.2 Types of lines and their applications

The basic line type and subtype number are provided in the first column of Table B.1. Line type application numbers are provided in the third column of Table B.1. Examples of applications are shown in Annex C.

Table B.1 — Types of lines and their application in construction technical drawings

No.	Description and representation	Application		Application reference
01.1	Continuous narrow line ———	.1	Boundaries of different materials in view, cut and section (alternatively, see no. 01.2.2)	ISO 7519
		.2	Hatching	ISO 128-3 ISO 7519
		.3	Diagonals for indication of openings, holes and recesses	ISO 7519
		.4	Arrow lines in stairs, ramps and sloping areas (indicating the top level)	ISO 7519
		.5	Modular grid lines, first stage	ISO 8560
		.6	Short centre lines	—
		.7	Extension lines	ISO 129-1
		.8	Dimension lines and their terminators	ISO 129-1
		.9	Leader lines	9.1
		.10	Existing contours on landscape technical drawings (alternatively, see no. 02.1.1)	ISO 11091
		.11	Visible outlines of parts in view (alternatively, see no. 01.2.3)	ISO 7519
		.12	Simplified representation of, for example, doors, windows, stairs for plan drawings, fittings (alternatively, see no. 01.2.4)	ISO 7519
		.13	Framing of details	ISO 128-3
	Continuous narrow lines with zigzags ——/\/\——	.14	Limits of partial or interrupted views, cuts and sections, if the limit is not a line 04.1 (alternatively, see no. 04.1.6)	—

Table B.1 *(continued)*

No.	Description and representation	Application		Application reference
01.2	Continuous wide line	.1	Visible outlines of parts in cut and section when hatching is used	ISO 7519
		.2	Boundaries of different materials in view, cut and section (alternatively, see no. 01.1.1)	ISO 7519
		.3	Visible outlines of parts in view (alternatively, see no. 01.1.11)	ISO 7519
		.4	Simplified representation of, for example, doors, windows, stairs, fittings (alternatively, see no. 01.1.12)	ISO 7519
		.5	Modular grid lines, second stage	ISO 8560
		.6	Arrow lines for marking of views, cuts and sections	ISO 128-3
		.7	Proposed contours on landscape technical drawings	ISO 11091
01.3	Continuous extra-wide line	.1	Visible outlines of parts in cut and section when hatching is not used	ISO 7519
		.2	Reinforcing bars (see no. 02.3.1)	ISO 3766
		.3	Lines of special importance	—
02.1	Dashed narrow line	.1	Existing contours on landscape technical drawings (alternatively, see no. 01.1.10)	ISO 11091
		.2	Subdivision of plant beds or grass	ISO 11091
		.3	Hidden outlines (alternatively, see no. 02.2.1)	—
02.2	Dashed wide line	.1	Hidden outlines (alternatively, see no. 02.1.3)	—
02.3	Dashed extra-wide line	.1	Reinforcing bars in bottom layer on plan and far face layer in elevation when bottom and top layers and near and far face layers are shown on the same sketch	ISO 3766
04.1	Long-dashed dotted narrow line	.1	Cutting planes (line 04.2 at ends and changes of direction)	ISO 128-3
		.2	Centre lines	ISO 129-1
		.3	Lines of symmetry (identified at the ends by two narrow short parallel lines drawn at right angles)	ISO 128-3
		.4	Framing of enlarged details	ISO 8560
		.5	Reference lines	—
		.6	Limits of partial or interrupted views, cuts and sections (especially for short lines and in narrow situations; see example no. 01.1.2, no. 01.2.1 and no. 01.3.1 in annex c; alternatively, see no. 01.1.14)	—
04.2	Long-dashed dotted wide line	.1	Cutting planes (at ends and changes of direction; see no. 04.1.1)	ISO 128-3
		.2	Outlines of visible parts situated in front of the cutting plane	—
04.3	Long-dashed dotted extra-wide line	.1	Secondary lines for setting out and arbitrary reference lines	ISO 4463-1 ISO 4463-3
		.2	Indication of covering to a surface, e.g. Cladding, lining, ceramic tiles	ISO 7437
		.3	Boundary lines for contracts, stages, zones	—

Table B.1 *(continued)*

No.	Description and representation	Application		Application reference
05.1	Long-dashed double-dotted narrow line ——— · · ——— · · —	.1	Alternative and extreme positions of movable parts	ISO 128-3
		.2	Centroidal line	ISO 129-5
		.3	Outlines of adjacent parts	ISO 128-3
		.4	Simplified representation of suspended ceiling	ISO 7519
05.2	Long-dashed double-dotted wide line ——— · · ——— · · —	.1	Outlines of hidden parts situated in front of the cutting plane	—
05.3	Long-dashed double-dotted extra-wide line ▬▬ · · ▬▬ · · ▬	.1	Reinforcing prestressed bars and cables	ISO 3766
07.1	Dotted narrow line	.1	Outlines of parts not included in the project	—

B.3 Line widths

In construction technical drawings, three line widths can be used: narrow, wide and extra-wide (see Table B.2).

The proportions of the line widths are 1:2:4.

A special line width is used for representation and lettering of graphical symbols. This line width is between the width of the narrow and the wide line.

Table B.2 — Line widths in construction technical drawings

Line group	Line widths for line no.			Line widths for graphical symbols
	01.1, 02.1, 04.1, 05.1, 07.1 Narrow line	01.2, 02.2, 04.2, 05.2 Wide line	01.3, 02.3, 04.3, 05.3 Extra-wide line	
0,25	0,13	0,25	0,5	0,18
0,35	0,18	0,35	0,7	0,25
0,5	0,25	0,5	1	0,35
0,7	0,35	0,7	1,4	0,5
1	0,5	1	2	0,7

The line widths shall be chosen according to the type, size and scale of the technical drawing and the requirements at microcopying and other methods of reproduction.

Annex C
(informative)

Examples of application in construction technical drawings

Examples of the application of the different types of lines, along with the corresponding reference numbers from Table B.1, are given in Table C.1.

The basic line type number and subtype number are provided in the first column of Table C.1. Line type application numbers are provided in the second column of Table C.1

Table C.1 — Examples of application in construction technical drawings

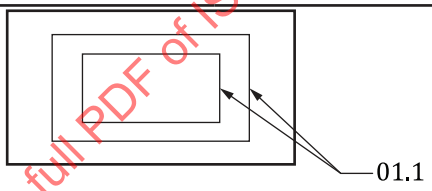
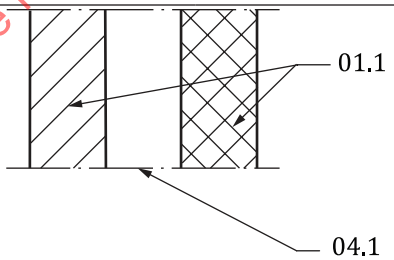
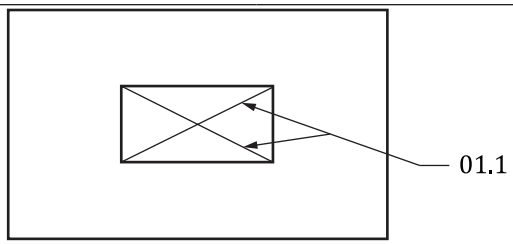
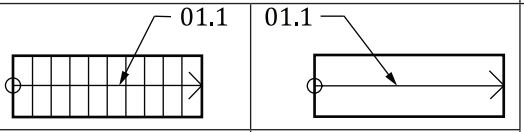
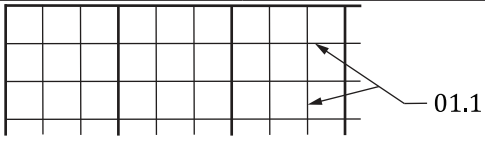
No.		Application	Example	Figure no.
01.1	.1	Boundaries of different materials in view, cut and section (alternatively, see no. 01.2.2)		C.1
	.2	Hatching		C.2
	.3	Diagonals for indication of openings, holes and recesses		C.3
	.4	Arrow lines in stairs, ramps and sloping areas (indicating the top level)		C.4
	.5	Modular grid, first stage		C.5
	.6	Short centre lines		C.6

Table C.1 *(continued)*

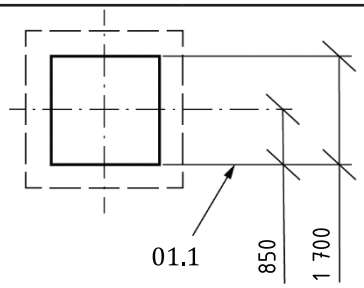
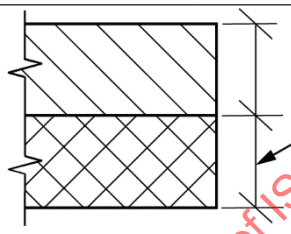
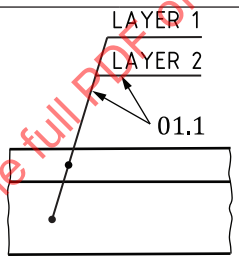
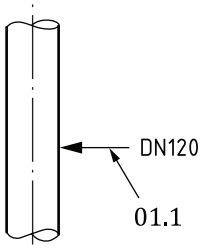
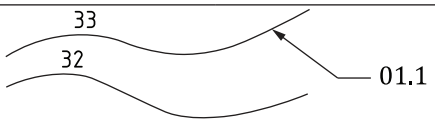
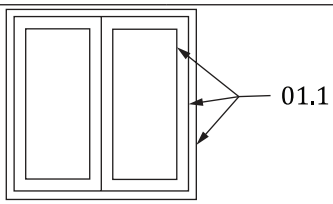
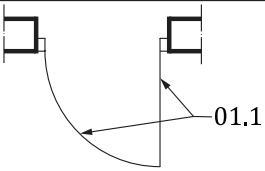
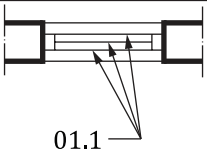
No.	Application		Example	Figure no.
	.7	Extension lines		C.7
	.8	Dimension lines		C.8
	.9	Leader lines and reference lines	 	C.9
	.10	Existing contours on landscape drawings		C.10
	.11	Visible outlines of parts in view (alternatively, see no. 01.2.3)		C.11
	.12	Simplified representation of, for example, doors, windows, fittings (alternatively, see no. 01.2.4)	 doors  windows	C.12

Table C.1 *(continued)*

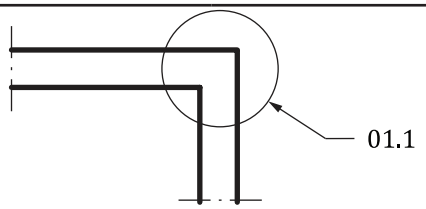
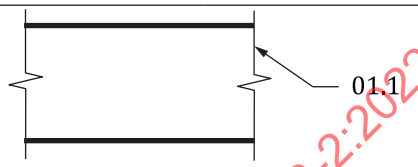
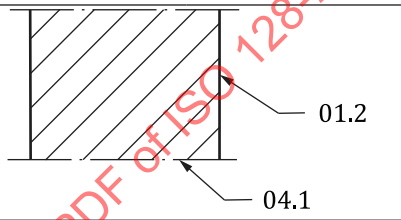
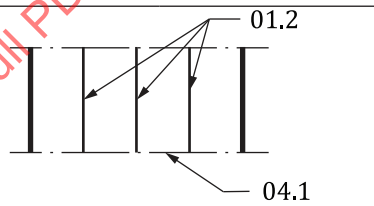
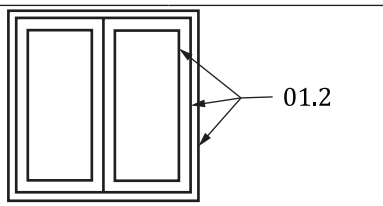
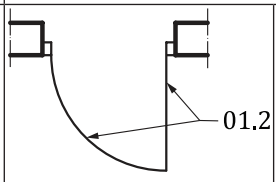
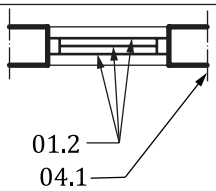
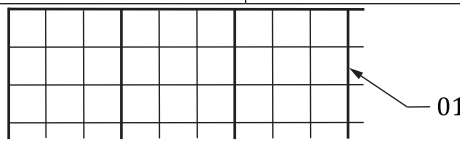
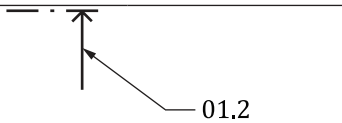
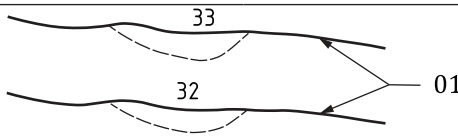
No.	Application		Example	Figure no.
	.13	Framing of details		C.13
	.14	Limits of partial or interrupted views, cuts and sections, if the limit is not a line 04.1		C.14
01.2	.1	Visible outlines of parts in cut and section when hatching is used		C.15
	.2	Boundaries of different materials in view, cut and section (alternatively, see no. 01.1.1)		C.16
	.3	Visible outlines of parts in view (alternatively, see no. 01.1.11)		C.17
	.4	Simplified representation of, for example, doors, windows, fittings (alternatively, see no. 01.1.12)	 doors  windows	C.18
	.5	Modular lines, second stage		C.19
	.6	Arrow lines for marking of views, cuts and sections		C.20
	.7	Proposed contours on landscape drawings		C.21

Table C.1 *(continued)*

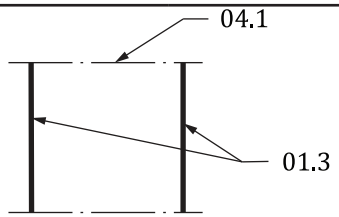
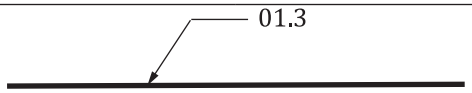
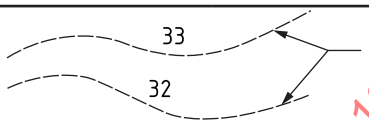
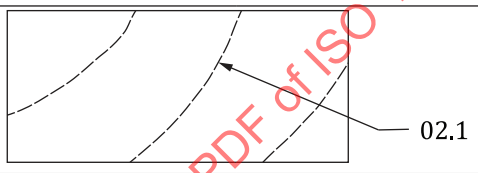
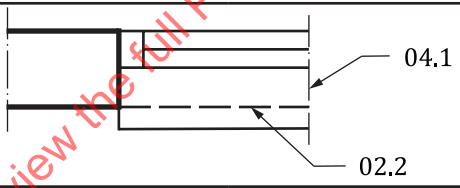
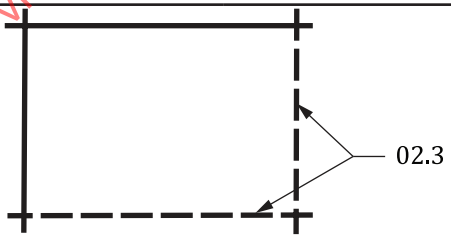
No.	Application		Example	Figure no.
01.3	.1	Visible outlines of parts in cut and section when hatching is not used		C.22
	.2	Reinforcing bars (see no. 02.3.1)		C.23
02.1	.1	Existing contours on landscape drawings (alternatively, see no. 01.1.10)		C.24
	.2	Subdivision of plant beds or grass		C.25
02.2	.1	Hidden outlines (alternatively, see no. 02.1.3)		C.26
02.3	.1	Reinforcing bars in bottom layer on plan and far face layer in elevation when bottom and top layers and near and far face layers are shown on the same sketch		C.27

Table C.1 *(continued)*

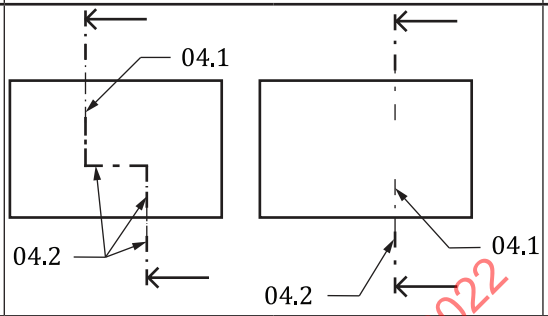
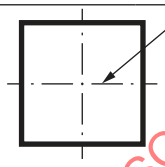
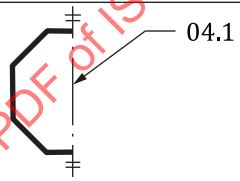
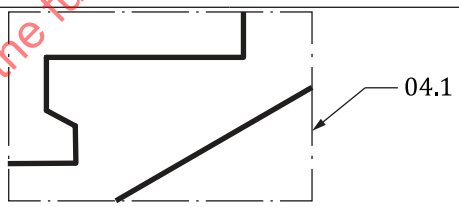
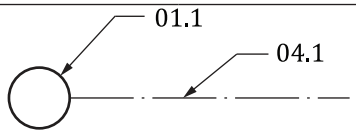
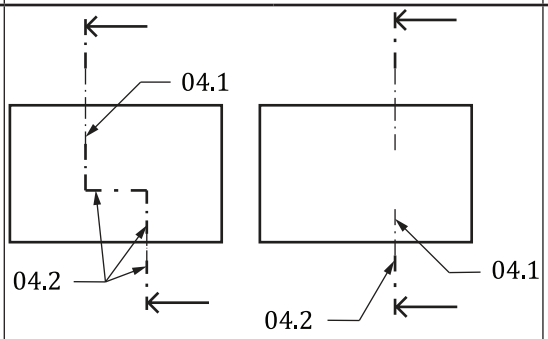
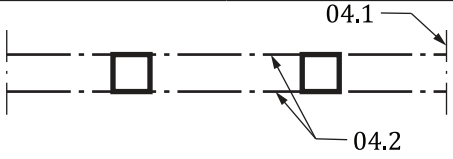
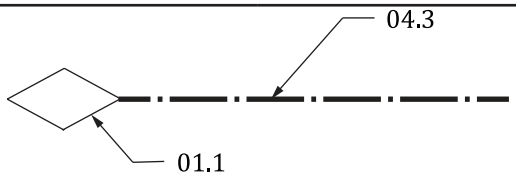
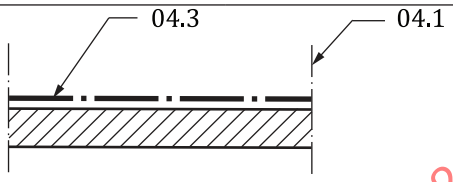
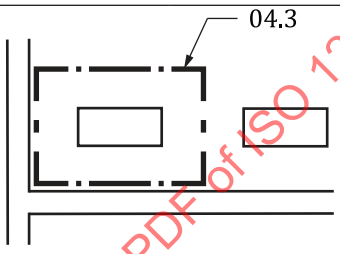
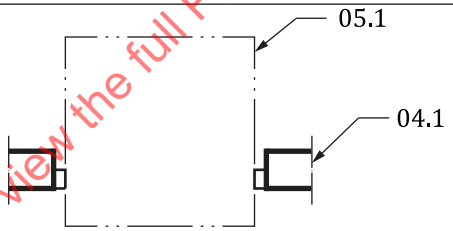
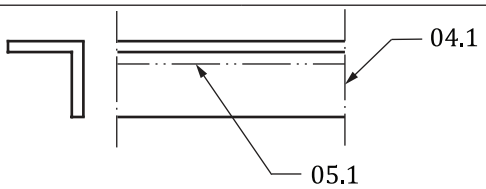
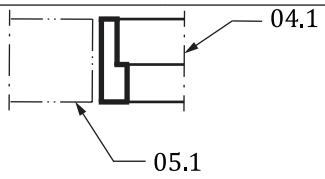
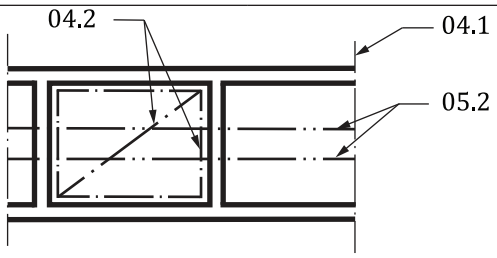
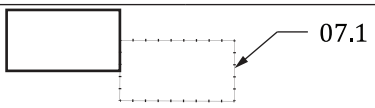
No.	Application		Example	Figure no.
04.1	.1	Cutting planes (drawn with line 04.2 at ends and changes of direction)		C.28
	.2	Centre lines		C.29
	.3	Lines of symmetry (identified at the ends by two narrow short parallel lines drawn at right angles)		C.30
	.4	Framing of enlarged details		C.31
	.5	Modular line in an axial position		C.32
04.2	.1	Cutting planes (drawn with line 04.2 at ends and changes of direction; the rest is drawn with line 04.1)		C.33
	.2	Outlines of visible parts situated in front of the cutting plane		C.34

Table C.1 *(continued)*

No.	Application		Example	Figure no.
04.3	.1	Secondary lines for setting out and arbitrary reference lines		C.35
	.2	Indication of lines or surfaces to which a special requirement applies		C.36
	.3	Boundary lines for contracts, stages, zones		C.37
05.1	.1	Alternative and extreme position of movable parts		C.38
	.2	Centroidal lines		C.39
	.3	Outlines of adjacent parts		C.40
05.2	.1	Outlines of hidden parts situated in front of the cutting plane		C.41
05.3	.1	Reinforcing prestressed bars and cables		C.42
07.1	.1	Outlines of parts not included in the project		C.43

Annex D
(normative)

Types of lines and their application in mechanical engineering technical drawings

D.1 Field of application

This annex specifies the types of lines and their application in mechanical engineering technical drawings.

The basic line type number and subtype number are provided in the first column of Table D.1. Line type application numbers are provided in the third column of Table D.1.

Examples of applications are shown in Annex E.

Table D.1 — Types of lines and applications

No.	Line description and representation	Application		Application reference	Figure E.54 key[a]
01.1	Continuous narrow line _____	.1	Imaginary lines of intersection	—	B 1
		.2	Dimension lines	ISO 129-1	B 2
		.3	Extension lines	ISO 129-1	B 3
		.4	Leader lines and reference lines	ISO 128-2 ISO 2553 ISO 12671	B 4
		.5	Hatching	ISO 128-3	B 5
		.6	Outlines of revolved sections	ISO 128-3	B 6
		.7	Short centre lines	—	B7
		.8	Root of screw threads	ISO 6410-1	B 8
		.9	Origin and terminations of dimension Lines	ISO 129-1	B 9
		.10	Diagonals for the indication of flat surfaces	ISO 128-3	B 10
		.11	Bending lines on blanks and processed parts	ISO 128-3	B 11
		.12	Framing of details	ISO 128-3	B 12
		.13	Indication of repetitive details, e.g. Root circle of gears	ISO 128-3 ISO 2203	B 13
		.14	Dimensioning and tolerancing gauge lines (for cones and wedges)	ISO 3040 ISO 2538-2	B 14
		.15	Location of laminations	ISO 128-3	B 15
		.16	Projection lines	ISO 5456-4	B 16
		.17	Grid lines (e.g. For graph, map)	—	B 17

[a] Letters and numbers correspond to the balloons shown in Figure E.54 a) to p).

[b] It is recommended that only one type of line is used per technical drawing.

Table D.1 *(continued)*

No.	Line description and representation	Application		Application reference	Figure E.54 key[a]
		.18	Axis of coordinate system	ISO 16972 ISO 129–1	—
	Continuous narrow freehand or freeform curve line	.19	Preferably manually represented termination of partial or interrupted views, cuts and sections, if the limit is not a line of symmetry or a centre line[b]	ISO 128-3	C 1
	Continuous narrow line with zigzags	.20	Mechanically represented termination of partial or interrupted views, cuts and sections, if the limit is not a line of symmetry or a centre line[b]	ISO 128-3	D 1
01.2	Continuous wide line	.1	Visible edges	ISO 128-3	A 1
		.2	Visible outlines	ISO 128-3	A 2
		.3	Crests of screw threads	ISO 6410-1	A 3
		.4	Limit of length of full depth thread	ISO 6410-1	A 4
		.5	Main representations in diagrams, maps, graphs, flow charts	—	A 5
		.6	Structural line (simplified representation of structural components)	ISO 5261	A 6
		.7	Parting lines of moulds in views	ISO 10135	A 7
		.8	Direction changes of lines of cuts and section arrows	ISO 128-3	A 8
02.1	Dashed narrow line	.1	Hidden edges	ISO 128-3	F 1
		.2	Hidden outlines	ISO 128-3	F 2
02.2	Dashed wide line	.1	Indication of permissible areas of surface treatment, e.g. Heat treatment, organic coatings, thermally sprayed coating	ISO 15787 ISO 12671	E 1
04.1	Long-dashed dotted narrow line	.1	Centre lines	ISO 129-1	G 1
		.2	Lines and planes of symmetry, situation features (as median features)	ISO 128-3 ISO 5459	G 2
		.3	Pitch circle of gears	ISO 2203	G 3
		.4	Pitch circle of holes	ISO 128-3 ISO 129-1	G 4
		.5	Indication of expected or wished spread of surface-hardened areas, e.g. Heat treatment	ISO 15787	G 5
		.6	Cutting line	ISO 128-3	G 6
		.7	Cutting plane	ISO 16792	H1
04.2	Long-dashed dotted wide line	.1	Indication of restricted area on surface, e.g. Heat treatment, organic coatings, thermally sprayed coating or restricted areas of a toleranced feature	ISO 15787 ISO 1101 ISO 129-1 ISO 10135 ISO 12671	J 1
		.2	Position of cutting planes	ISO 128-3	J 2

[a] Letters and numbers correspond to the balloons shown in Figure E.54 a) to p).

[b] It is recommended that only one type of line is used per technical drawing.

Table D.1 *(continued)*

No.	Line description and representation	Application		Application reference	Figure E.54 key[a]
05.1	Long-dashed double-dotted narrow line ——— · · ——— · · —	.1	Outlines of adjacent parts, contacting features	ISO 128-3 ISO 5459	K 1
		.2	Extreme positions of movable parts	ISO 128-3	K 2
		.3	Centroidal lines	ISO 129-5	K 3
		.4	Initial outlines prior to forming	ISO 128-3 ISO 129-1	K 4
		.5	Parts situated in front of a cutting plane	—	K 5
		.6	Outlines of alternative executions	—	K 6
		.7	Outlines of the finished part within blanks	ISO 128-3 ISO 10135	K 7
		.8	Framing of particular fields or limited areas for adhesive, brazing and soldering	ISO 15785 ISO 15787	K 8
		.9	Projected tolerance feature	ISO 1101	K 9
		.10	Optical axes	ISO 10110-1	K 10
		.11	Indication of structural outlines used in mechanical processes	ISO 15787	K 11
		.12	Outline of datum target areas	ISO 5459	K12
07.2	Dotted wide line	.1	Indication of areas where heat treatment is not permissible	ISO 15787	L 1
09.2	Long-dashed double-short-dashed wide line — – – —— – – —	.1	Situation features (as non-median features)	ISO 5459	M1

[a] Letters and numbers correspond to the balloons shown in Figure E.54 a) to p).

[b] It is recommended that only one type of line is used per technical drawing.

D.2 Hierarchy of overlapping lines

If two or more lines of different type are overlapping, the hierarchy should be as shown in Table D.2 (see Figure E.54 in Annex E).

Table D.2 — Types of lines and applications

Level of hierarchy	Line	
	No.	Application
1	01.2	visible edges and outlines
2	01.1.18	limits of partial or interrupted views
	01.1.19	limits of partial or interrupted views
	02.1	hidden edges and outlines
3	02.2	hidden outlines
	04.2	cutting planes
	07.2	heat treatment is not permissible
4	04.1	centre lines
5	05.1	centroidal lines
6	01.1	extension lines; without line type 01.1.14

D.3 Line widths and line groups

In mechanical engineering technical drawings, two line widths are normally used. The proportions between the line widths should be 1:2.

The line groups are specified in Table D.3

Table D.3 — Line groups in mechanical engineering technical drawings

Dimensions in millimetres

Line group	Line width for line no.	
	01.1, 02.1, 04.1, 05.1 Narrow line	01.2, 02.2, 04.2, 07.2 Wide line
0,25	0,13	0,25
0,35	0,18	0,35
0,5[a]	0,25	0,5
0,7[a]	0,35	0,7
1	0,5	1
1,4	0,7	1,4
2	1	2

[a] Preferred line groups.

The widths and groups of lines should be chosen according to the type, size and scale of the technical drawing and according to the requirements for microcopying and/or other methods of reproduction.

Annex E
(informative)

Examples of application in mechanical engineering technical drawings

E.1 Examples of application

Table E.1 gives examples of the application of the different types of lines indicating the reference number given in Table D.1. The figures are shown in first-angle projection. It is understood that third-angle projection can also be used.

The basic line type number and subtype number are provided in the first column of Table E.1. Line type application numbers are provided in the second column of Table E.1.

Table E.1 — Examples of application in mechanical engineering technical drawings

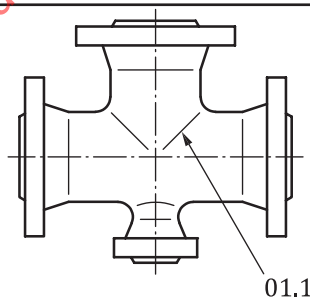
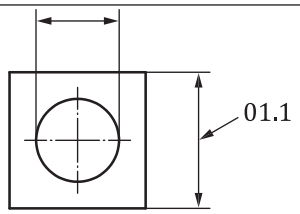
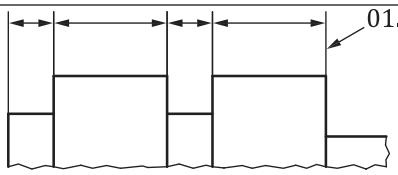
No.		Application	Example	Figure no.
01.1	.1	Imaginary lines of intersection		E.1
	.2	Dimension lines		E.2
	.3	Extension lines		E.3

Table E.1 *(continued)*

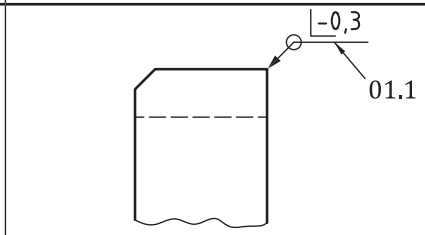
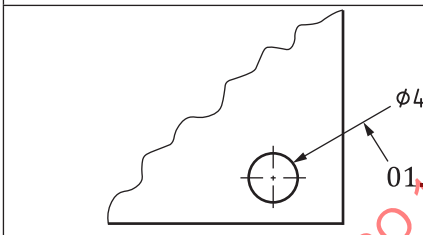
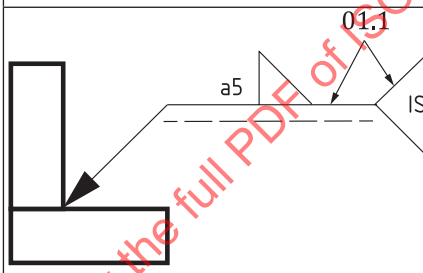
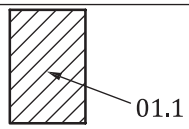
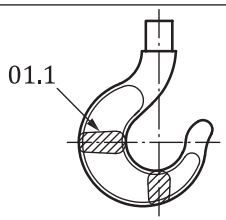
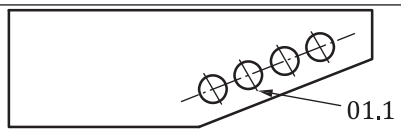
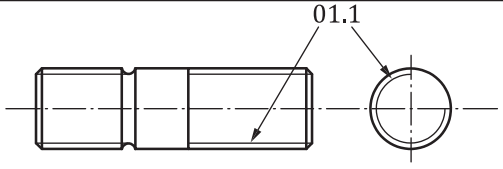
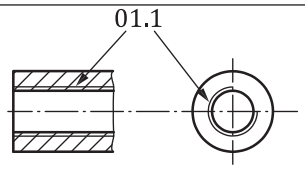
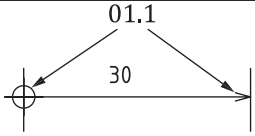
No.	Application		Example	Figure no.
	.4	Leader lines, reference lines and tile		E.4
				
				
	.5	Hatching		E.5
	.6	Outlines of revolved sections		E.6
	.7	Short centre lines		E.7
	.8	Root of screw threads		E.8
				
	.9	Origin and terminations of dimension lines		E.9

Table E.1 *(continued)*

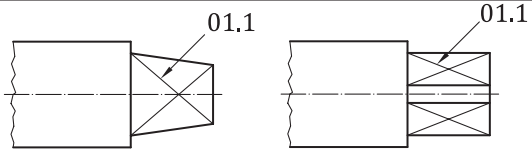
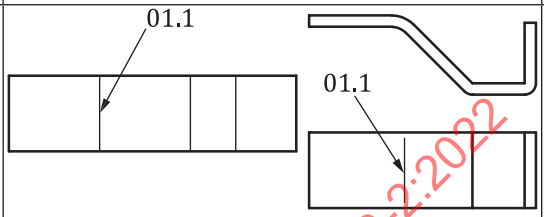
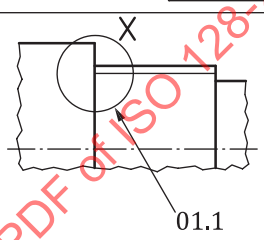
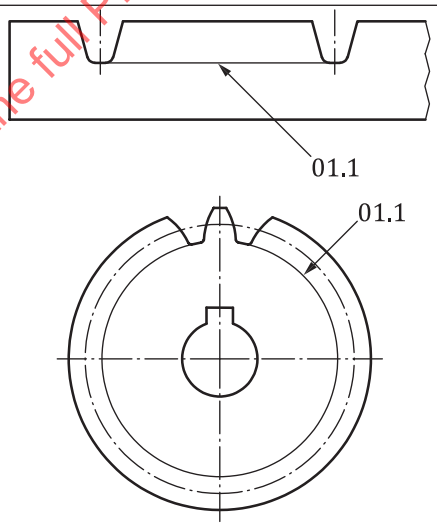
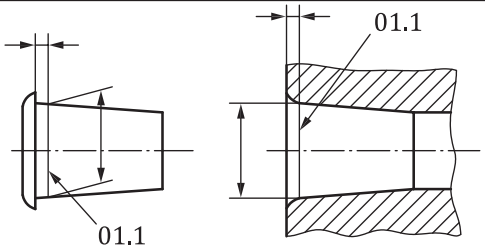
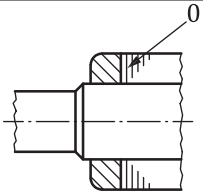
No.	Application		Example	Figure no.
	.10	Diagonals for the indication of flat surfaces		E.10
	.11	Bending lines on blanks and processed parts		E.11
	.12	Framing of details		E.12
	.13	Indication of repetitive features, e.g. root circle of gears		E.13
	.14	Dimensioning and tolerancing lines (for cones and wedges)		E.14
	.15	Location of laminations, e.g. transformer plates		E.15

Table E.1 *(continued)*

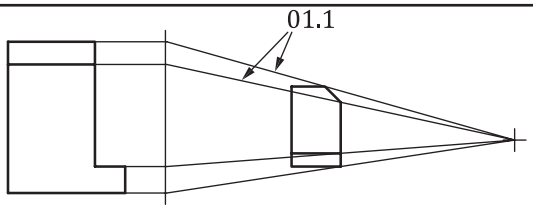
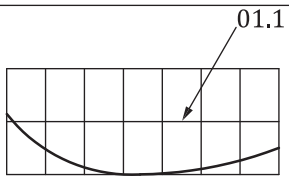
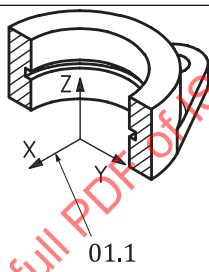
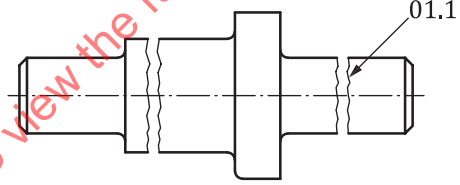
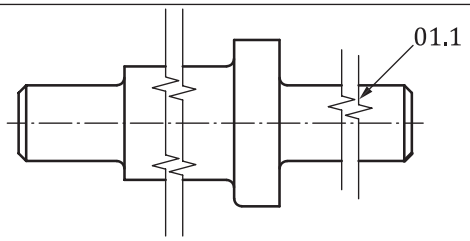
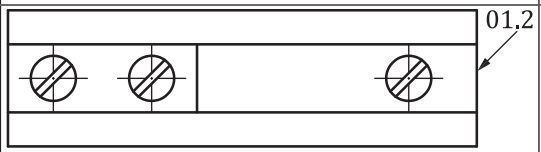
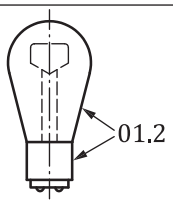
No.	Application		Example	Figure no.
	.16	Projection lines		E.16
	.17	Grid lines		E.17
	.18	Axis of coordinate system		E.18
	.19	Continuous narrow freehand or free-form curve lines		E.19
	.20	Continuous narrow lines with zigzags		E.20
01.2	.1	Visible edges		E.21
	.2	Visible outlines		E.22

Table E.1 *(continued)*

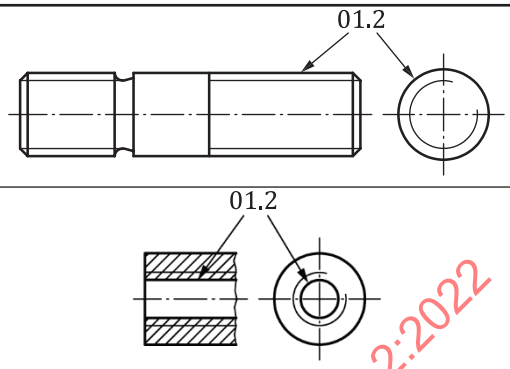
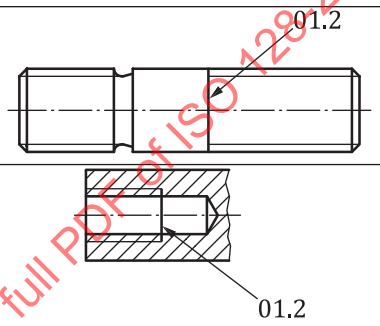
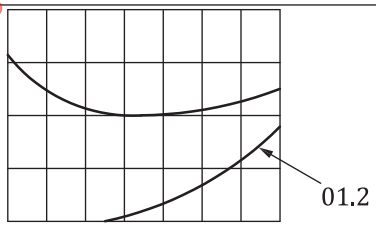
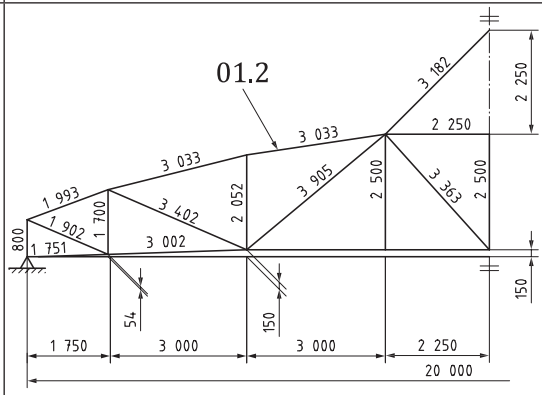
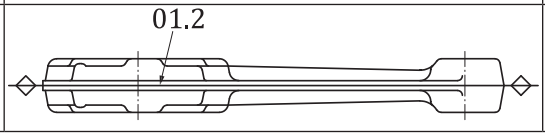
No.	Application		Example	Figure no.
	.3	Crests of screw threads		E.23
	.4	Limit of length of full-depth thread		E.24
	.5	Main representations in diagrams, maps, graphs, flow charts		E.25
	.6	Structural line (simplified representation of structural components)		E.26
	.7	Parting lines of moulds in views		E.27

Table E.1 *(continued)*

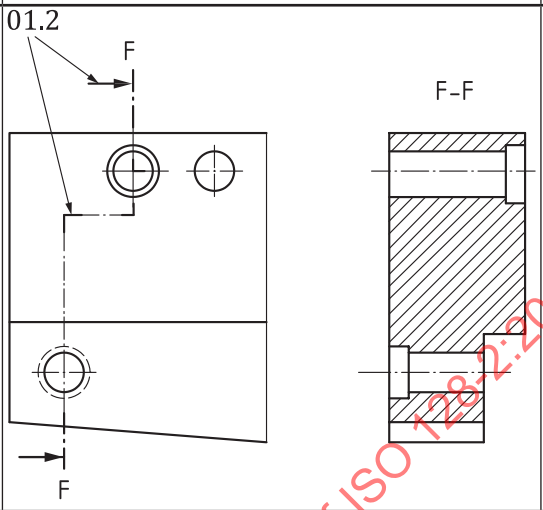
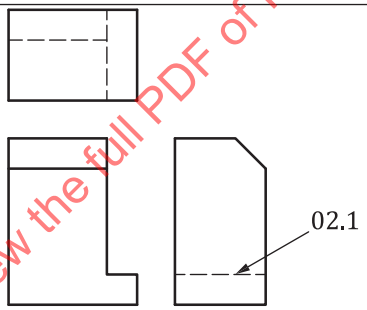
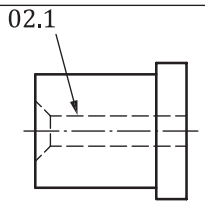
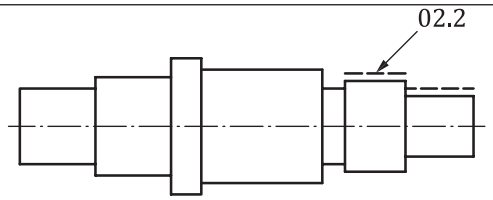
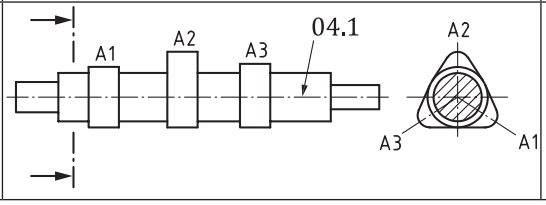
No.	Application		Example	Figure no.
	.8	Direction changes of lines of cuts and section arrows		E.28
02.1	.1	Hidden edges		E.29
	.2	Hidden outlines		E.30
02.2	.1	Indication of the permissible surface treatment, e.g. heat treatment, organic coatings, thermally sprayed coatings		E.31
04.1	.1	Centre lines		E.32

Table E.1 *(continued)*

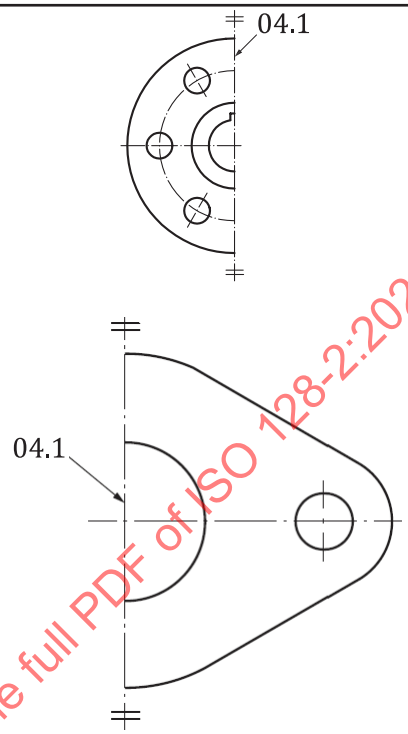
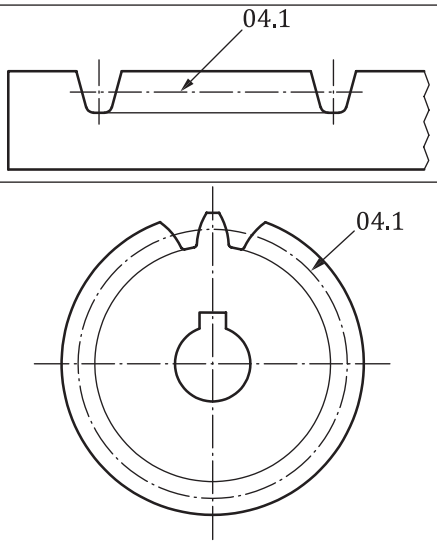
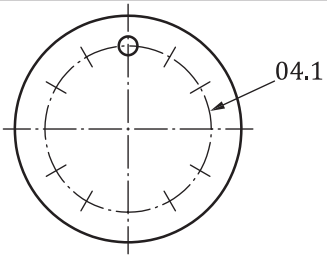
No.	Application		Example	Figure no.
	.2	Lines and planes of symmetry		E.33
	.3	Pitch circles of gears		E.34
	.4	Pitch circles of holes		E.35

Table E.1 *(continued)*

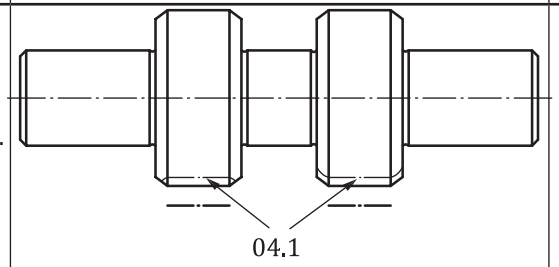
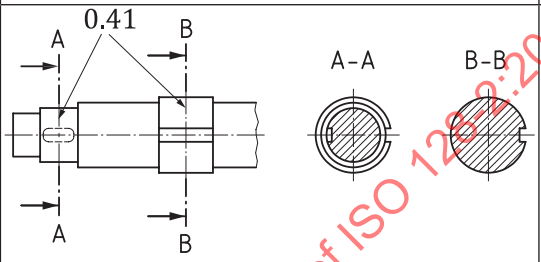
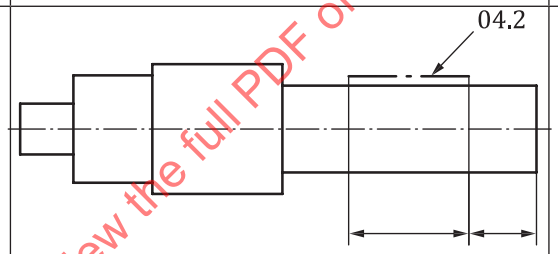
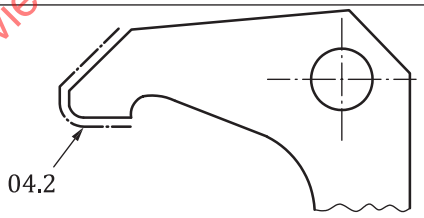
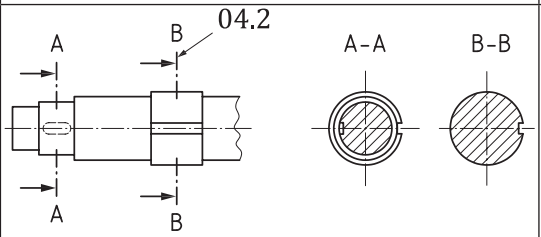
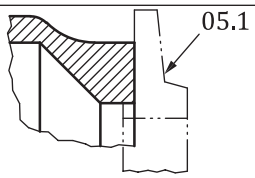
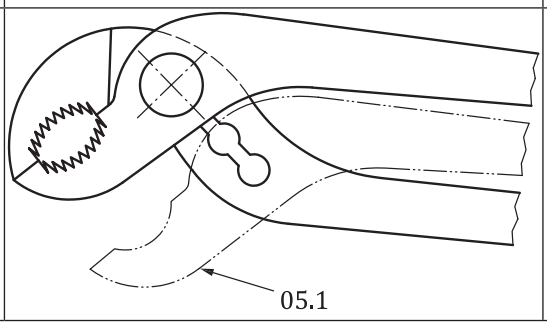
No.		Application	Example	Figure no.
	.5	Indication of expected or wished spread of surface-hardened areas, e.g. heat treatment		E.36
	.6	Cutting line		E.37
04.2	.1	Indication of restricted area on surface, e.g. heat treatment, organic coatings, thermally sprayed coating or restricted areas of a toleranced feature	 	E.38
	.2	Position of cutting planes		E.39
05.1	.1	Outlines of adjacent parts		E.40
	.2	Extreme positions of movable parts		E.41

Table E.1 *(continued)*

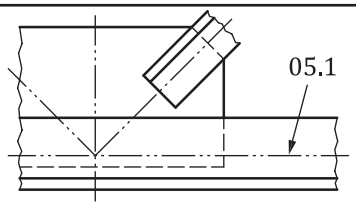
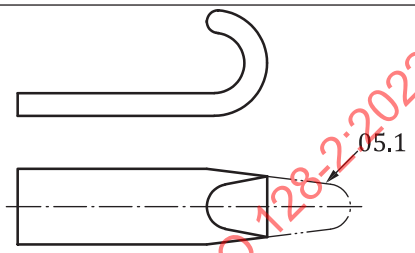
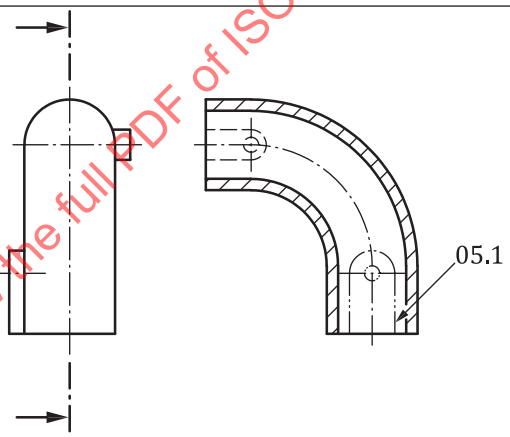
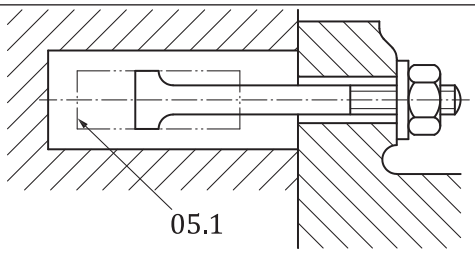
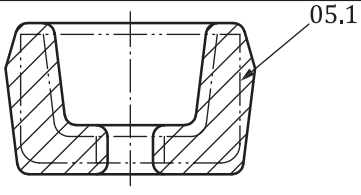
No.	Application		Example	Figure no.
	.3	Centroidal lines		E.42
	.4	Initial outlines prior to forming		E.43
	.5	Parts situated in front of a cutting plane		E.44
	.6	Outlines of alternative executions		E.45
	.7	Outlines of the finished part within blanks		E.46

Table E.1 *(continued)*

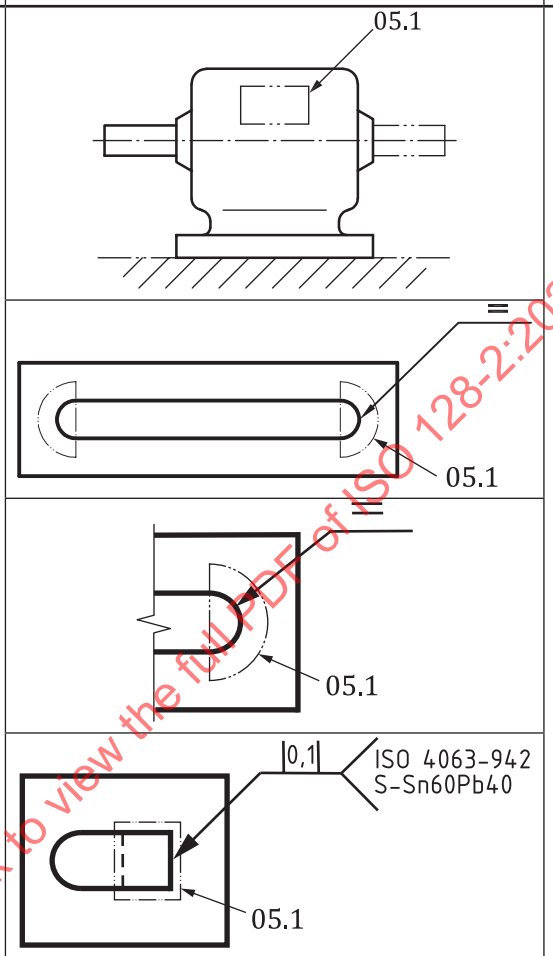
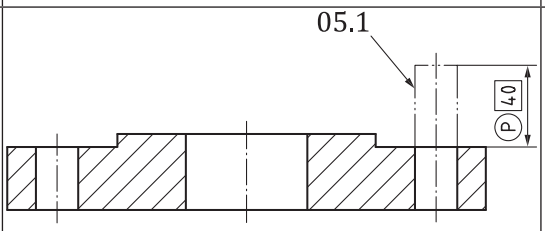
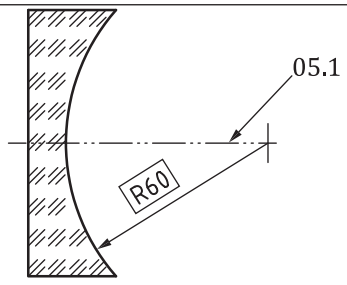
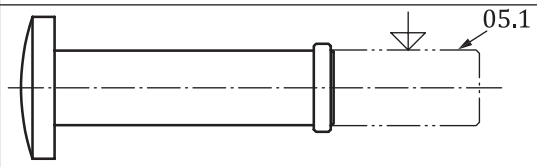
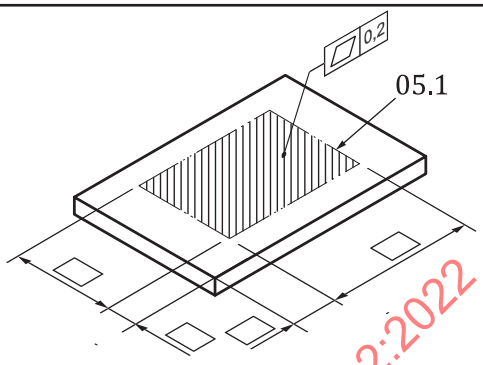
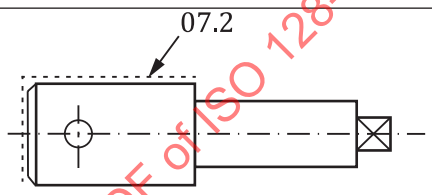
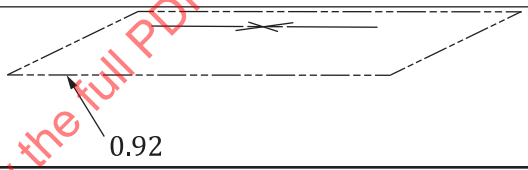
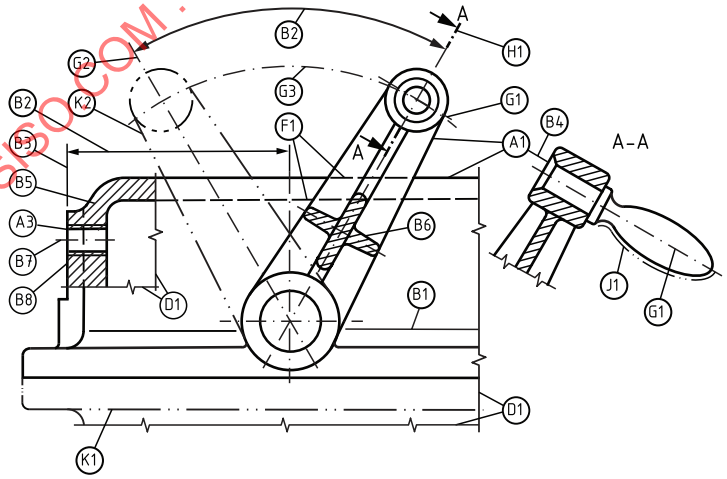
No.	Application		Example	Figure no.
	.8	Framings of particular fields or areas, limited area for adhesive, brazing and soldering		E.47
	.9	Projected toleranced features		E.48
	.10	Optical axis		E.49
	.11	Indication of structural outlines used in mechanical processes		E.50

Table E.1 *(continued)*

No.	Application		Example	Figure no.
	.12	Outline of datum target areas		E.51
07.2	.1	Indication of areas where heat treatment is not permissible		E.52
09.2	.1	Situation feature (as non-median features)		E.53

E.2 Examples of hierarchy of overlapping lines

Figure E.54 a) to p) give examples of the hierarchy of overlapping lines. See the figure key in Table D.1 for line type identification.



a)

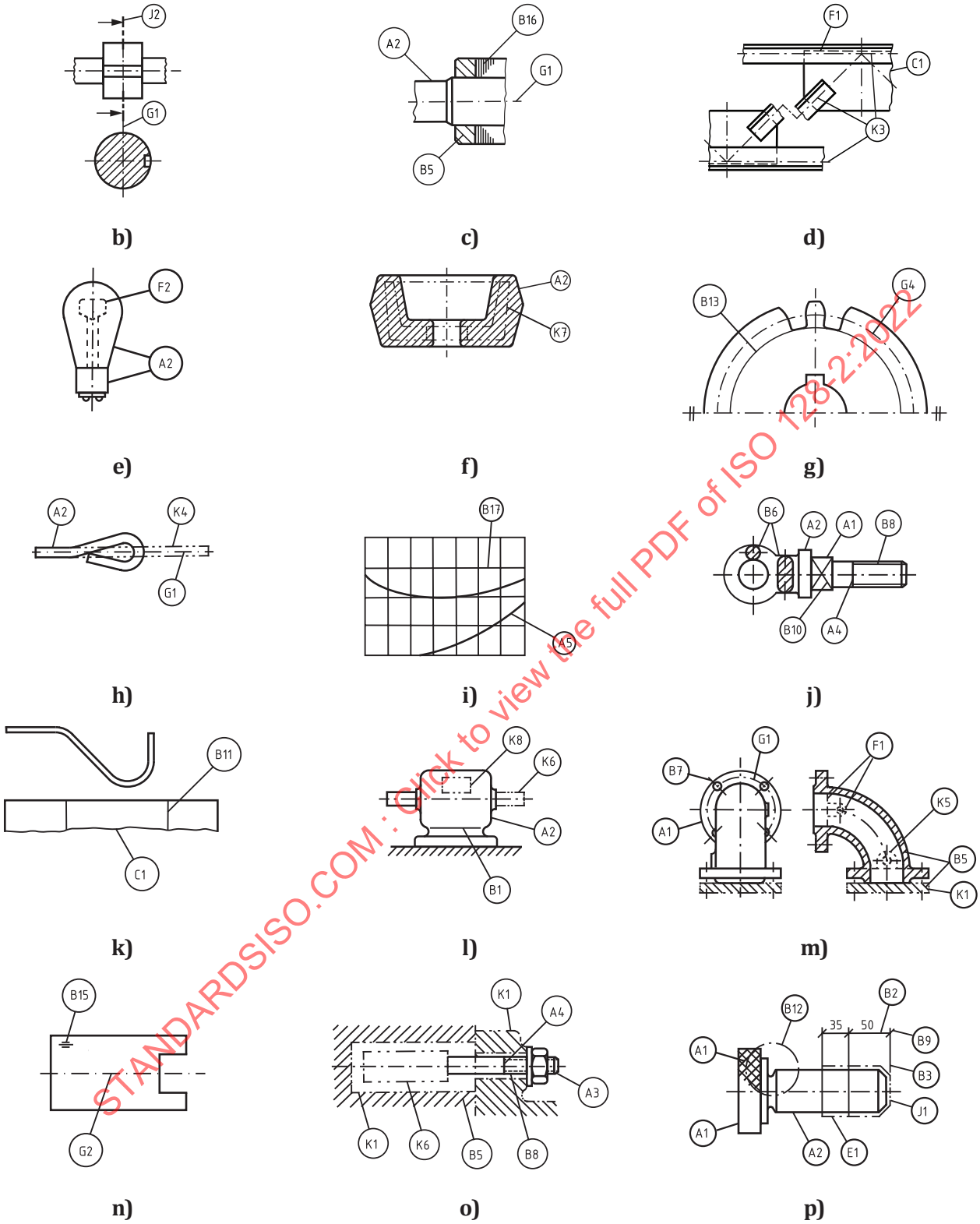


Figure E.54 — Examples of hierarchy