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

**Part 3:
Views, sections and cuts**

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

Partie 3: Vues, sections et coupes



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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 128-3:2020), of which it constitutes a minor revision, and ISO 128-43:2015. The changes are as follows:

- [Clause 2](#): reference to ISO 10209 has been updated;
- [Figures A.3, A.4, A.5, B.4, D.10, E.1](#) and [E.2](#) have been redrawn to be consistent with the text;
- 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 views, sections and cuts in all kinds of technical product documentation. The first-angle projection method (formerly referred to as method E) and the third-angle projection method (formerly referred to as method A) are described in more detail in ISO 5456-2.

All figures in this document, excluding [Figure 1](#), [Figure 6](#) and [Figure 7](#), have been drawn in first-angle projection method unless other methods are stated. 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 views, sections and cuts within drawings of special technical fields varies considerably. Therefore, rules of application specific to technical fields are given in [Annexes C](#), [D](#), [E](#) and [F](#).

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

Part 3: Views, sections and cuts

1 Scope

This document specifies the general principles for presenting views, sections and cuts applicable to various kinds of technical drawings (e.g. mechanical, electrical, architectural, civil engineering), following the orthographic projection methods specified in ISO 5456-2. Views and sections for shipbuilding technical drawings are discussed in ISO 128-15. Views and sections for 3D models are discussed in ISO 16792.

Attention has also been given in this document to the requirements of reproduction, including microcopying in accordance with ISO 6428.

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 128-2:—,¹⁾ *Technical product documentation (TPD) — General principles of presentation — Part 2: Basic conventions for lines*

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

ISO 3098-1, *Technical product documentation — Lettering — Part 1: General requirements*

ISO 5456-2, *Technical drawings — Projection methods — Part 2: Orthographic representations*

ISO 6428, *Technical drawings — Requirements for microcopying*

ISO 10209:2022, *Technical product documentation — Vocabulary — Terms relating to technical drawings, product definition and related documentation*

ISO 15519-1, *Specification for diagrams for process industry — Part 1: General rules*

ISO 81714-1, *Design of graphical symbols for use in the technical documentation of products — Part 1: Basic rules*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 10209:2022 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>

1) Under preparation. Stage at the time of publication: ISO/FDIS 128-2:2022.

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

3.1

cut

sectional view

section (3.2) showing, in addition, outlines beyond the cutting plane

Note 1 to entry: While “cut” is generally used in the construction field, “section” is generally used in the mechanical engineering field, regardless of the definitions in 3.1 or 3.2.

[SOURCE: ISO 10209:2022, 3.2.10, modified — Note 1 to entry added.]

3.2

section

representation showing only the outlines of an object lying in one or more cutting planes

Note 1 to entry: While “cut” is generally used in the construction field, “section” is generally used in the mechanical engineering field, regardless of the definitions in 3.1 or 3.2.

[SOURCE: ISO 10209:2022, 3.2.58, modified — Note 1 to entry revised.]

3.3

technical drawing

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

Note 1 to entry: For the purpose of this document, the term “technical drawing” is interpreted in the broadest possible sense, encompassing the total package of documentation specifying the product (work piece, subassembly, assembly).

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

4 Basic conventions for views

4.1 General information on views

The most informative view of an object shall be used as the principle view, taking into consideration, for example, its functioning position, position of manufacturing or mounting.

Each view, with the exception of the front or principal figure (view, plan, principal figure), shall be given clear identification with a capital letter, repeated near the reference arrow needed to indicate the direction of viewing for the relevant view. Whatever the direction of viewing, the capital letter shall always be positioned in normal relation to the direction of reading and be indicated either above or on the right side of the reference arrow.

The reference arrow is defined in [Annex A](#) (for the former practice of arc arrow, see [Annex B](#)), as is the lettering height of the identification.

The designated views may be located irrespective of the principal figure. The capital letters identifying the referenced views shall be placed immediately above the relevant views (see [Figure 1](#)).

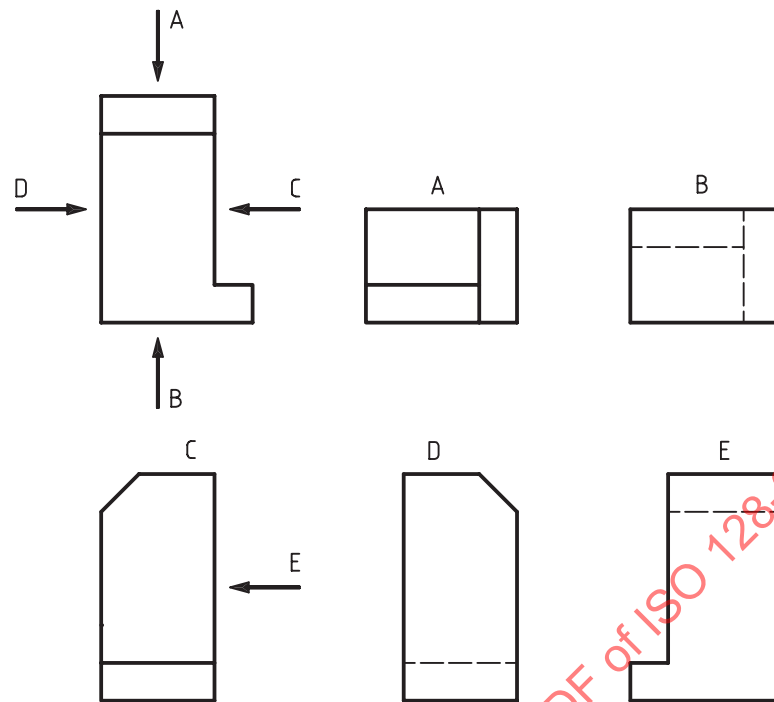


Figure 1 — Identification of referenced views

For applying views and sections to mechanical engineering technical drawings, [Annex C](#) and [Annex D](#) shall apply. For applying projection methods in building technical drawings, [Annex E](#) shall apply. For applying views, sections and cuts to construction technical drawings, [Annex F](#) shall apply.

4.2 Choice of views

When views (including cuts and sections) are needed, these shall be selected according to the following principles:

- limit the number of views (and cuts and sections) to the minimum necessary but sufficient to fully delineate the object without ambiguity;
- avoid the need for hidden outlines and edges;
- avoid unnecessary repetition of a detail.

Views and sections for 3D models are given in ISO 16792.

4.3 Partial views

Features needing specific illustration, but not meriting a full view, can be illustrated using a partial view limited by a continuous narrow line with zigzags of type 01.1 according to ISO 128-2:— (see [Figure 2](#)).

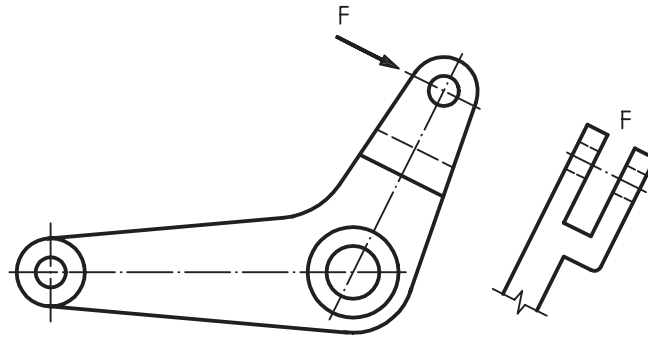
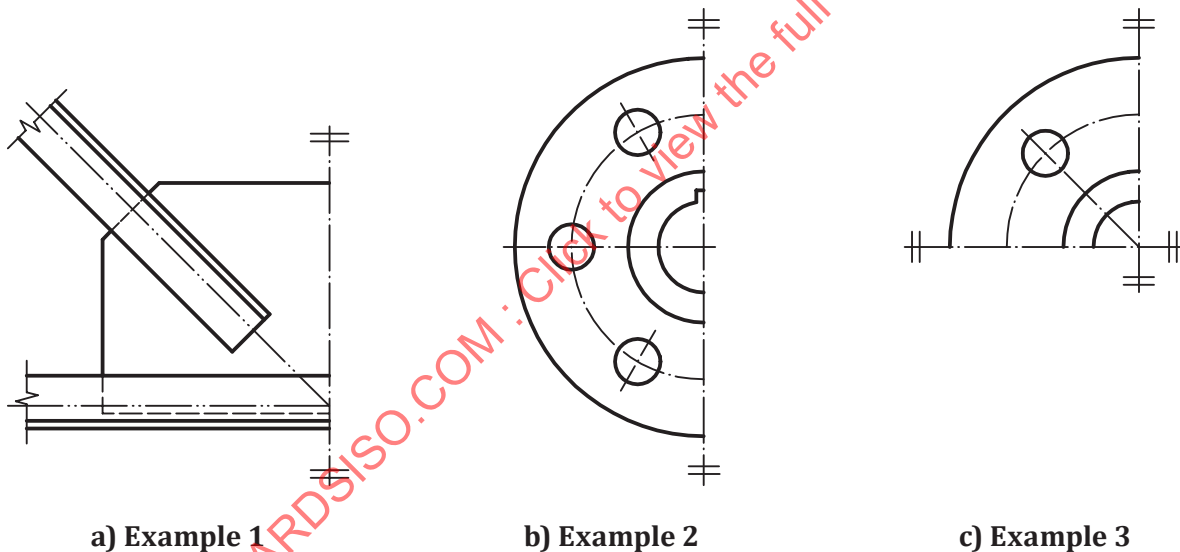


Figure 2 — Partial view

4.4 Simplified view of symmetrical parts

To save time and space, symmetrical objects can be drawn as a fraction of the whole [see [Figure 3](#) a), b) and c)].

The line of symmetry is identified at each of its ends by two narrow short parallel lines drawn at right angles to it [see [Figure 3](#) a), b) and c)]. The graphical symbol for symmetry shall be drawn in accordance with [A.3](#).



a) Example 1

b) Example 2

c) Example 3

Figure 3 — Examples of simplified views of symmetrical parts

4.5 First-angle projection method

The first-angle projection method, if used, shall be in accordance with ISO 5456-2.

4.6 First-angle projection method views

With reference to the front view, (a), the other views are arranged as follows (see [Figure 4](#)):

- the view from above, (b), is placed underneath;
- the view from below, (e), is placed above;
- the view from the left, (c), is placed on the right;

- the view from the right, (d), is placed on the left;
- the view from the rear, (f), may be placed on the left or right, as convenient.

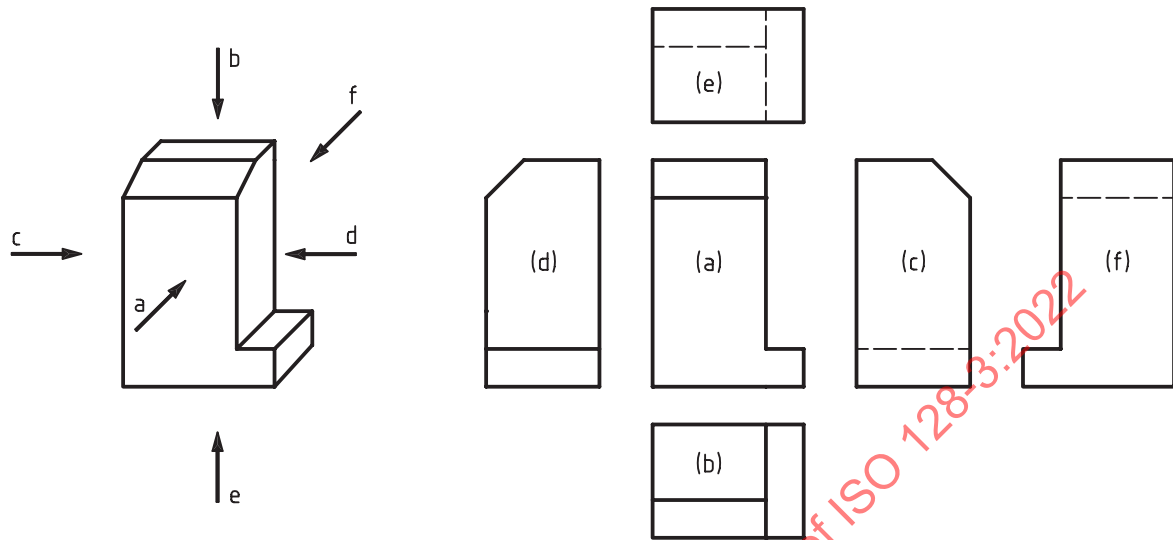


Figure 4 — First-angle projection method

4.7 First-angle projection graphical symbol

The graphical symbol for the first angle projection method is shown in [Figure 5](#). The proportions and dimensions of this graphical symbol are specified in ISO 5456-2.

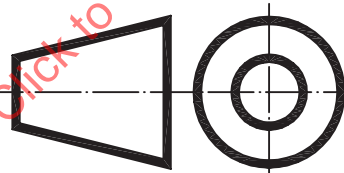


Figure 5 — First angle projection graphical symbol

4.8 Third-angle projection method

The third-angle projection method, if used, shall be in accordance with ISO 5456-2.

4.9 Third-angle projection method views

With reference to the front view, (a), the other views are arranged as follows (see [Figure 6](#)):

- the view from above, (b), is placed above;
- the view from below, (e), is placed underneath;
- the view from the left, (c), is placed on the left;
- the view from the right, (d), is placed on the right;
- the view from the rear, (f), may be placed on the left or right, as convenient.

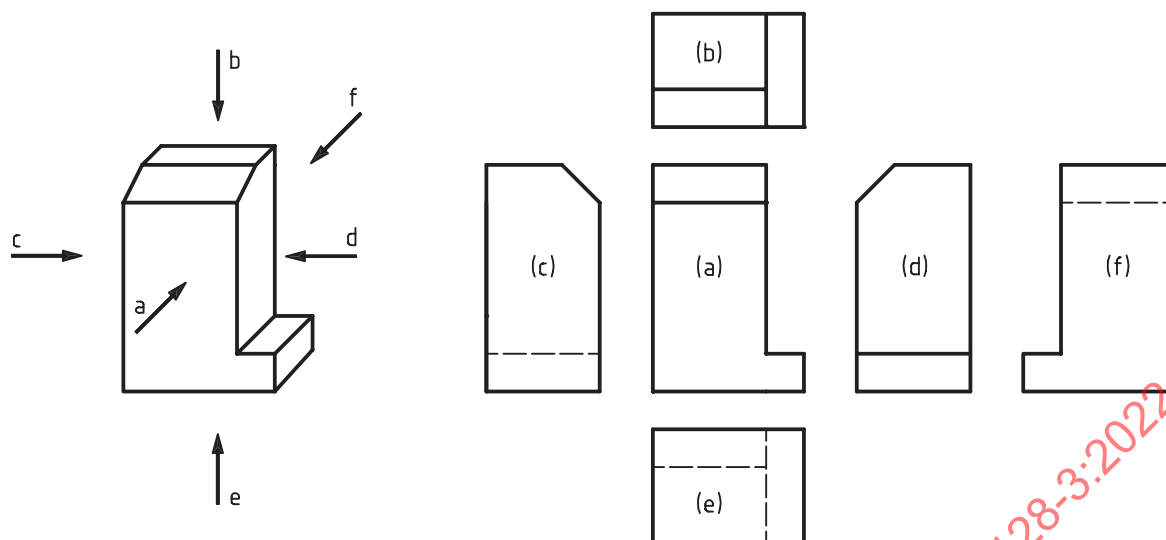


Figure 6 — Third-angle projection method

4.10 Third-angle projection graphical symbol

The graphical symbol for the third-angle projection method is shown in Figure 7. The proportions and dimensions of this graphical symbol are specified in ISO 5456-2.

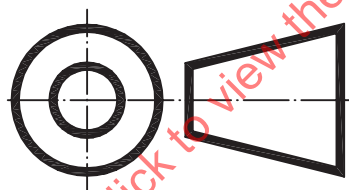


Figure 7 — Third-angle projection graphical symbol

4.11 Other projection methods

Refer to ISO 5456-2 for information on other projection methods, such as mirrored orthographic projections.

4.12 Enlarged features

When the scale of a technical drawing does not allow all features to be clearly shown or dimensioned, the unclear features shall be enclosed or encircled by a continuous narrow line (type 01.1), with the area thus enclosed identified by a capital letter. The features in the area shall also be shown on an enlarged scale, in a view that is broken with a continuous narrow freehand or free-formed curve line (type 01.1). This shall be accompanied by the identification letter and an indication of the scale beside it between parentheses, as shown in Figure 8. The rules for lettering height are discussed in Annex A.

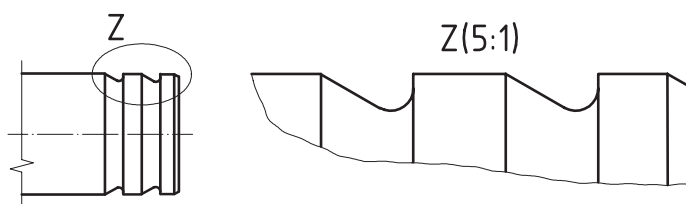


Figure 8 — Enlarged features

For unambiguous relation between the circle and the identification letter, a leader line by a continuous narrow line (type 01.1) and a reference line by a continuous narrow line (type 01.1) should be drawn. See [Figure 9](#).

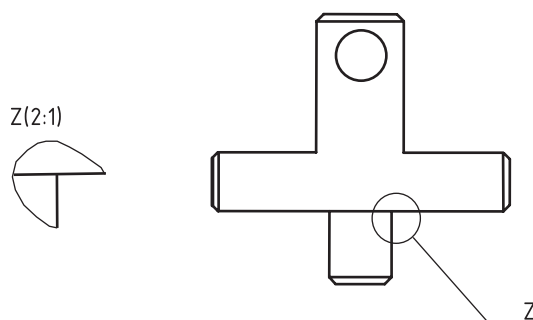


Figure 9 — Enlarged features with leader line

5 Reference indication for views and enlarged features

5.1 General

On large-format mechanical technical drawings and technical drawings consisting of more than one drawing sheet with an extensive amount of views and enlarged features, the readability should be improved by information (reference indication) after the identification letter of the views.

The purpose is to find the views and the identification letters more easily on the technical drawing or drawings.

On construction drawings, designations for views and enlarged features can be complemented by general reference to other drawings containing the views or features.

5.2 Details of the reference indication

The reference indication after the identification letter on the views shall be in accordance with ISO 15519-1.

Examples with explanation are shown in [Figure 10](#) and [Figure 11](#).

Solidus (/) for identification of a sheet

Scale (given in brackets) if applicable

Identification letter of the view, etc.

Notation (example)

Z(1:2) /.B3

Full stop (.) for identification of a column, a row or a zone in a sheet

Zone (on the same drawing and sheet)

Figure 10 — Details of the reference indication with a single drawing

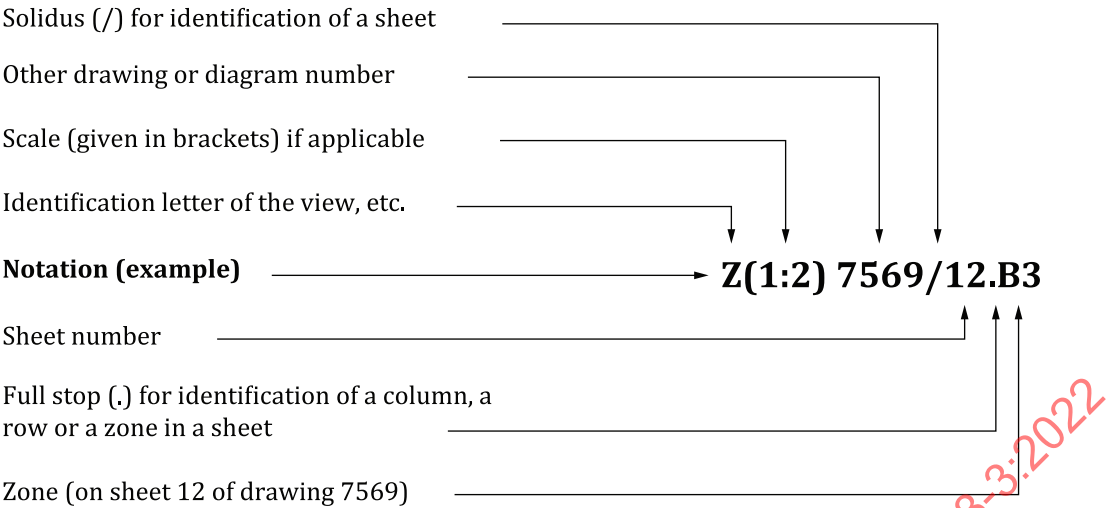
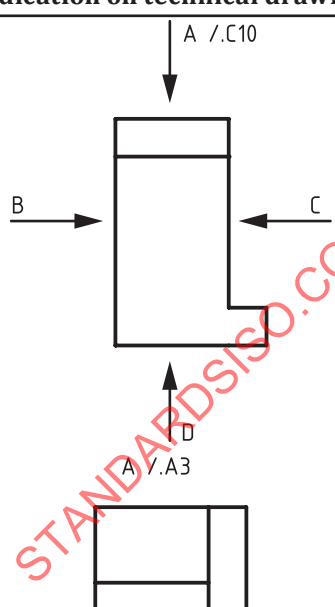
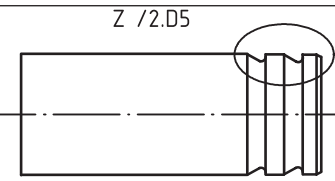
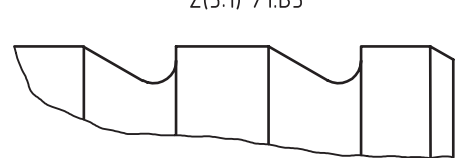


Figure 11 — Details of the reference indication with multiple drawings

5.3 Examples of indication

Examples of indication are given in Table 1.

Table 1 — Examples of indication

Indication on technical drawing	Interpretation
	<p>View A is represented at technical drawing coordinates C10 on the same sheet.</p> <p>The identification letter and reference arrow on the main view is represented at technical drawing coordinates A3 on the same sheet.</p>
	<p>Enlarged feature Z is represented at technical drawing coordinates D5 on sheet 2.</p>
	<p>The indication of the enlarged feature Z is represented at technical drawing coordinates B3 on sheet 1.</p>

6 General information on cuts and sections

6.1 General

The general rules for the arrangement of views apply equally when drawing cuts and sections.

6.2 Indication of cuts and sections

6.2.1 Cutting plane

The position of the cutting plane(s) shall be indicated by means of a cutting line represented with a dashed dotted wide line (type 10.2) according to ISO 128-2:—, Annex E and Annex G. A straight cutting plane shall be drawn (see [Figure 12](#)).

If the cutting plane changes its direction, the cutting line should only be drawn at the ends of the cutting plane, where the cutting plane changes direction (see [Figure 13](#)).

If necessary for its legibility, the cutting line may be connected with a long-dashed dotted narrow line of the type 04.1 according to ISO 128-2:—, Annex D or 04.1 according to ISO 128-2:—, Annex F.

The direction of viewing for the relevant cut and section is indicated by the reference arrows as defined in [Annex A](#).

The designated cut and section can be located irrespective of the view in which the cutting plane is taken.

Representation of areas on cuts and sections is covered in [Clause 7](#).

6.2.2 Identification of the cutting plane

Each cut and section plane shall be given clear identification with twice the same capital letter, once at each of the cut and section arrows. This identification should be positioned for reading from the bottom of the technical drawing.

The 30° or 90° cut and section arrow is defined in [A.4](#), as is the lettering height of the identification.

6.2.3 Identification of the cuts and sections

The identification of the referenced cuts and sections shall be placed immediately above the relevant representation. (see [Figure 12](#) and [13](#)).

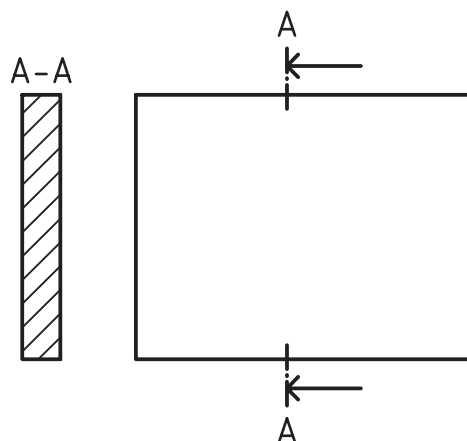


Figure 12 — Example from construction field

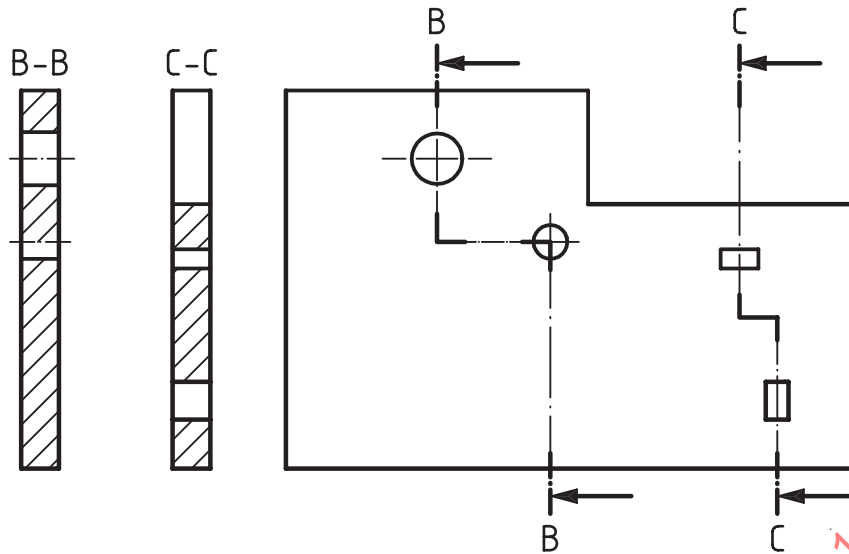


Figure 13 — Example from mechanical engineering field

6.2.4 Reference indication for cuts and sections

6.2.4.1 General

On large-format technical drawings and technical drawings consisting of more than one drawing sheet with an extensive number of cuts and sections, the readability should be improved by information (reference indication) after the identification letter of the cutting plane and the identification letters of the referenced cuts and sections.

The purpose is to find the cuts and sections and the identification letters more easily on the technical drawing or drawings.

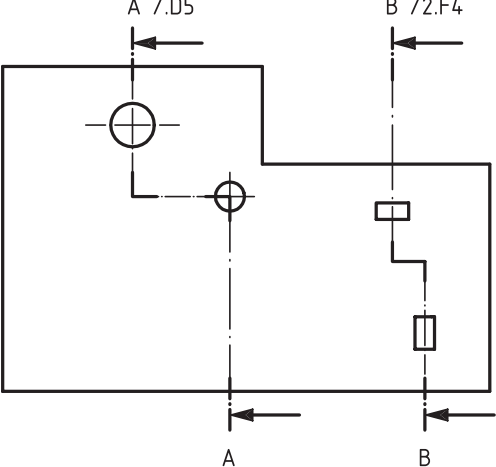
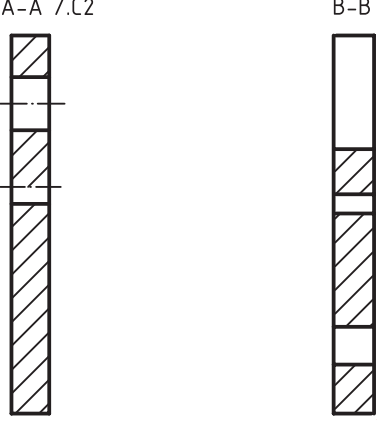
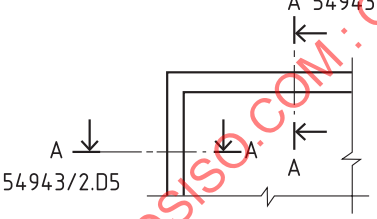
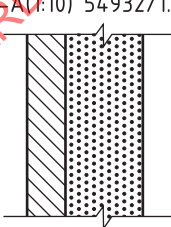
The cut and section arrows shall be drawn in accordance with [A.5](#).

6.2.4.2 Details of the reference indication

The reference indication after the identification letter on the views shall be in accordance with ISO 15519-1.

Examples with explanation are shown in [Figure 10](#) and [Figure 11](#) and [Table 2](#).

Table 2 — Examples of indication

Indication on technical drawing	Interpretation
	<p>Section A-A is represented at technical drawing coordinates D5 of the same sheet.</p> <p>Section B-B is represented at technical drawing coordinates F4 on drawing sheet 2.</p>
	<p>Cutting plane identification A is represented at technical drawing coordinates C2 of the same sheet.</p> <p>Cutting plane identification B is represented at technical drawing coordinates A8 on drawing sheet 1.</p>
	<p>Section A-A is represented on technical drawing number 54934 on sheet 2 at coordinates D5.</p>
	<p>Cutting plane identification A is represented on technical drawing 54932 on sheet 1 at coordinates A8.</p>

6.3 Sections revolved in the relevant view

If unambiguous, a section can be revolved in the relevant view. If this is done, the outline of the section shall be drawn with continuous narrow lines of the type 01.1 according to ISO 128-2:—. Further identification is then not necessary [see [Figure 14](#) a) and b)].

NOTE The rotational direction of the section in the view is unknown.

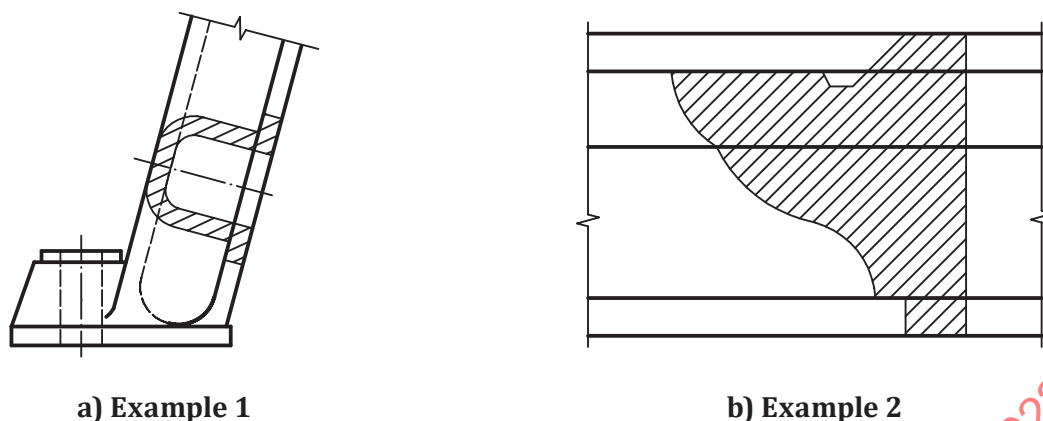


Figure 14 — Sections revolved in relevant view

6.4 Cuts/sections of symmetrical parts

Symmetrical parts may be drawn half in view and half in cut or section (see [Figure 15](#)).

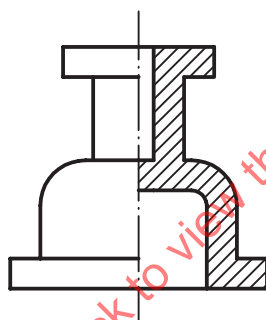


Figure 15 — Half in cut or section of symmetrical part

6.5 Local cuts/sections

A local cut or section may be drawn if a complete or a half cut or section is unnecessary. The local break shall be shown by a continuous narrow line (type 01.1) with zigzags or freehand or freeform curve according to ISO 128-2: — See [Figure 16](#).

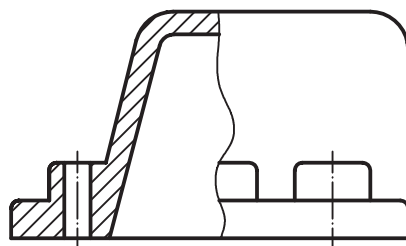


Figure 16 — Local cut or section

7 Basic conventions for representing areas on cuts and sections

7.1 General information on cuts and sections

There are six methods for the representation of areas on cuts and sections. These consist of indication:

- by hatching (see 7.2);
- by shading or toning (see 7.3);
- by extra-wide continuous outlines (see 7.4);
- of thin sections (see 7.5);
- of thin adjacent sections (see 7.6);
- of special materials (see 7.7).

Allowance shall be made for the means of reproduction used, in accordance with ISO 6428.

7.2 Hatching

Hatching shall be done with parallel narrow continuous lines of type 01.1 according to ISO 128-2:—, and at a convenient angle chosen in such a way that the hatching can be distinguished the best from the principal outlines. For example, for a rectangular outline the angle used for the hatching should be 45° (see Figure 17).

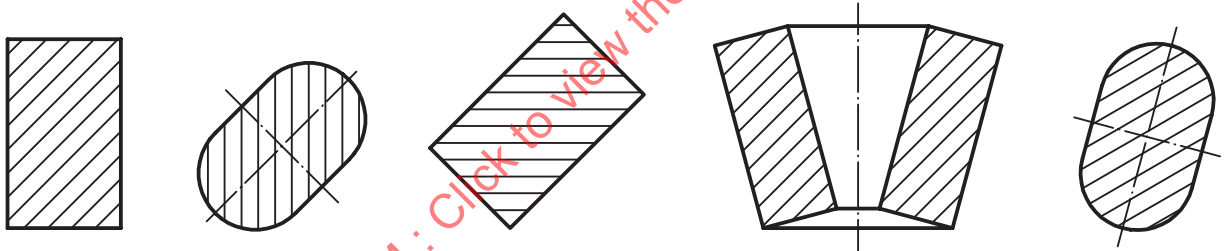


Figure 17 — Examples of hatching of areas of cuts or sections

Separate areas of a cut or section of the same component shall be hatched in an identical manner. The hatching of adjacent components shall be carried out using the specified lines running in different directions or differently spaced (see Figure 18).

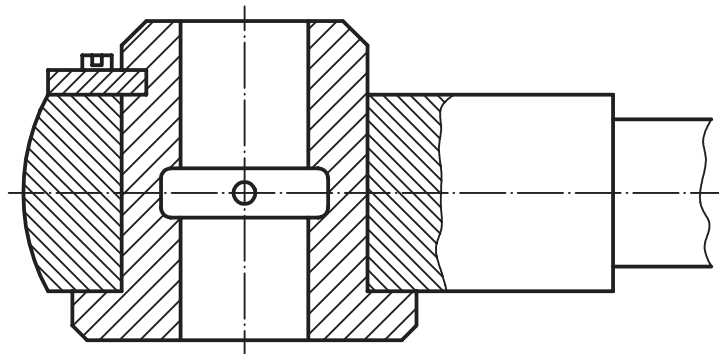


Figure 18 — Hatching of adjacent areas

Spacing between the hatching lines should be chosen in proportion to the size of the hatched areas, provided this is in accordance with the requirements for minimum spacing given in ISO 128-2.

Where cuts or sections of the same part in parallel are shown side by side, the hatching shall be identical (see [Figure 19](#)) but may be offset along the dividing line between the cuts or sections for greater clarity.

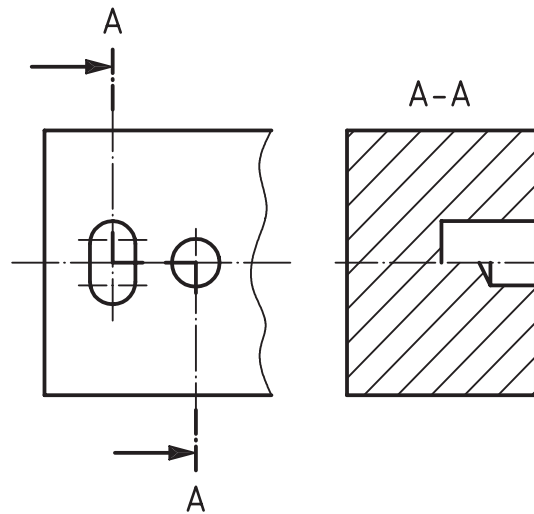


Figure 19 — Hatching of an area parallel cuts or sections

In the case of a large area, the hatching may be limited to a zone that follows the contour of the area (see [Figure 20](#)).



Figure 20 — Hatched contour of large area

Hatching shall be interrupted for inscriptions inside an area (see [Figure 21](#)).

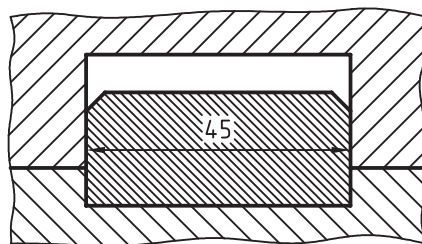


Figure 21 — Hatching interrupted by inscription

7.3 Shading or toning

Shading can consist of a pattern of dots or an overall toning of area (see [Figure 22](#)).

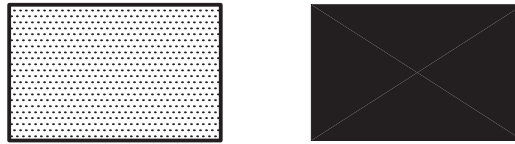


Figure 22 — Shading using dots and toning

Spacing between dots should be chosen in proportion to the size of a shaded area. In the case of a large area, the shading may be limited to a zone that follows the area's contour ([Figure 20](#)).

Hatching, shading or toning shall be interrupted for inscriptions inside an area ([Figure 21](#)).

7.4 Extra-wide continuous outlines

Areas of cuts and sections can be emphasized by the extra-wide continuous line specified in ISO 128-2 (see [Figure 23](#)).

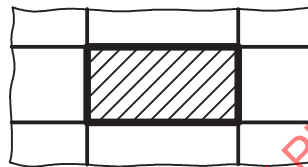


Figure 23 — Extra-wide continuous outline for emphasis

7.5 Thin sections

Thin sections can be shown entirely in black (see [Figure 24](#)). This is a special use case of toning.

This method shall represent the nominal geometry of median or inner or outer surfaces depending on the dimensioning according to ISO 129-1.



Figure 24 — Thin sections

7.6 Thin adjacent sections

Solid sections can be shown entirely in black. A space of not less than 0,7 mm shall be left between adjacent sections of this type. See [Figure 25](#).

This method does not represent the nominal geometry of median surfaces.

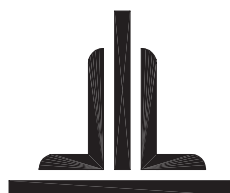


Figure 25 — Thin adjacent sections

7.7 Specific materials

Different types of special representation can be used to indicate specific materials. If a special representation is used, its signification shall be clearly defined on the technical drawing (e.g. by a legend or by reference to appropriate documents).

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Annex A (normative)

Graphical symbols

A.1 Graphical symbols for use in views

In order to harmonize the sizes of the graphical symbols specified in this document with those of the other inscriptions on the technical drawing (e.g. dimensions, tolerances), the rules given in ISO 81714-1 shall apply.

The view identification lettering height, h , shall be larger than the normal lettering on the technical drawing by a factor of $\sqrt{2}$.

Within [Figures A.1](#) and [A.2](#), lettering type B, vertical, according to ISO 3098-1, applies. Other lettering types are also permitted.

A.2 Reference arrow symbol

See [Figure A.1](#).

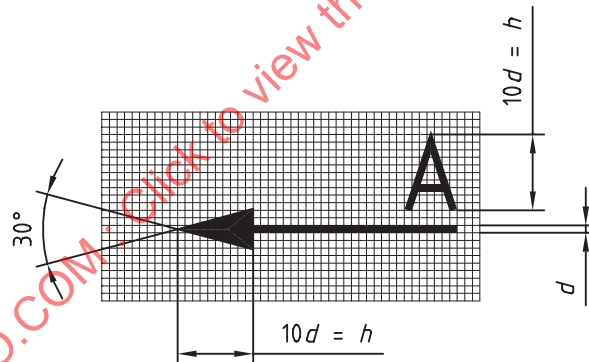


Figure A.1 — Graphical symbol for reference arrows

A.3 Symmetry symbol

See [Figure A.2](#).

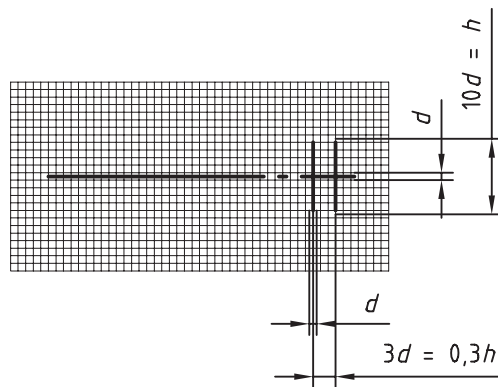


Figure A.2 — Graphical symbol for symmetry

A.4 Graphical symbols for cuts and sections

In order to harmonize the sizes of the graphical symbols specified in this document with those of the other inscriptions on the technical drawing (e.g. dimensions, tolerances), the rules given in ISO 81714-1 shall apply.

The cut and section identification lettering height, h , shall be larger than the normal lettering on the technical drawing by a factor of $\sqrt{2}$.

Within [Figures A.3](#) and [A.4](#), lettering type B, vertical, according to ISO 3098-1, applies. Other lettering types are also permitted.

A.5 Cut and section arrows

See [Figure A.3](#) for 30° cut and section arrows, [Figure A.4](#) for 90° cut and section arrows and [Figure A.5](#) for 90° cut and section arrows for mirrored orthographic projection. The line portion of the arrow is two grid units ($2d$) wide.

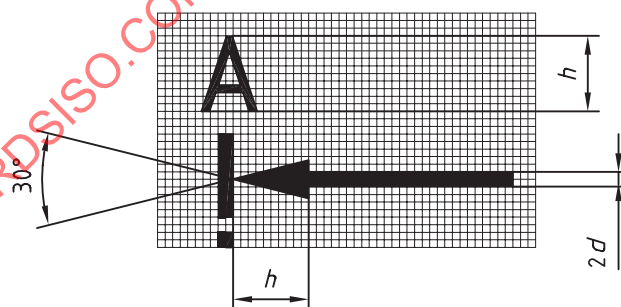


Figure A.3 — 30° cut and section arrow

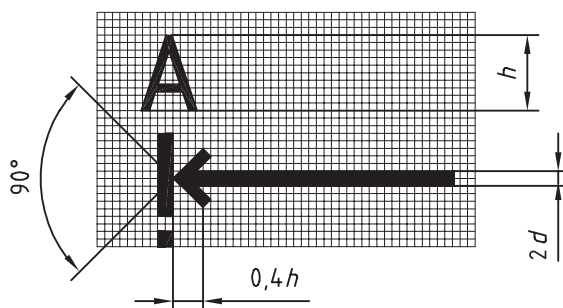


Figure A.4 — 90° cut and section arrow

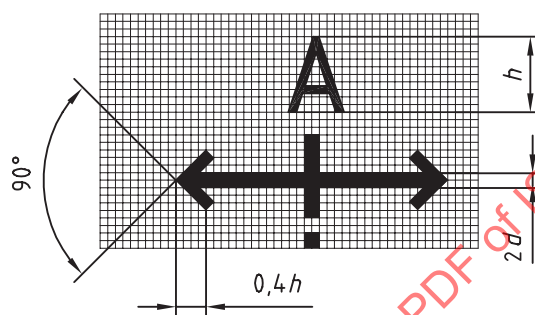


Figure A.5 — 90° cut and section arrow for mirrored orthographic projection

Annex B (informative)

Former practices

B.1 Use of arc arrow in special position of views

When necessary, it is permitted to show the view in another position than that indicated by the reference arrow.

The fact that the view is shown in another position should be clarified by an arc arrow showing the direction of rotation according to Figure B.1 a) and b). The angle of rotation of the view after the capital letter can be indicated. If used, the sequence shall be:

“view identification — arc arrow — angle of rotation”

The arc arrow shall be drawn in accordance with Figure B.2.

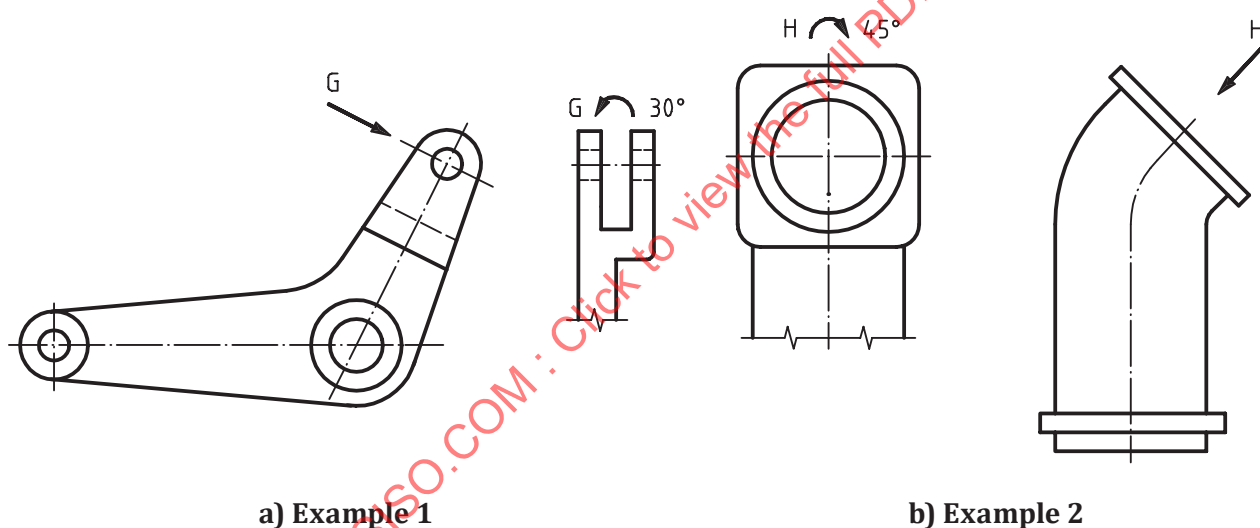


Figure B.1 — Special view positions

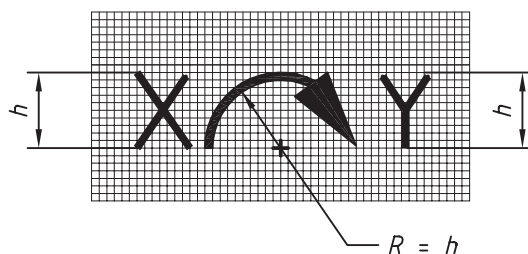


Figure B.2 — Graphical symbol for arc arrows

B.2 Section of parts of revolution with rotated cutting plane

In the case of parts of a revolution containing regularly spaced details required to be shown in sections but not situated in the cutting plane, these details may be depicted rotated into the cutting plane, provided that no ambiguity can arise (see [Figure B.3](#)). No additional identification is needed.

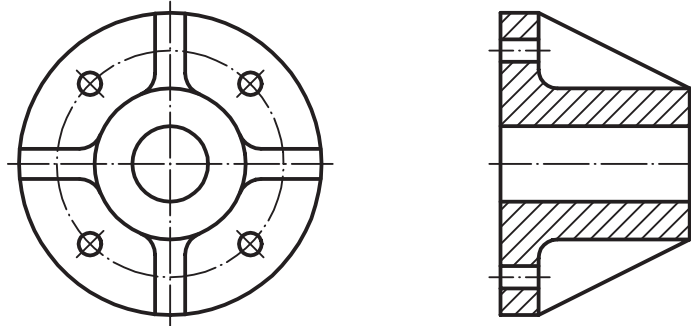


Figure B.3 — Section of part of revolution with regularly spaced details not in, but rotated into, the cutting plane

B.3 Arrangement of successive sections

Successive sections can be arranged in a manner similar to the example shown in [Figure B.4](#).

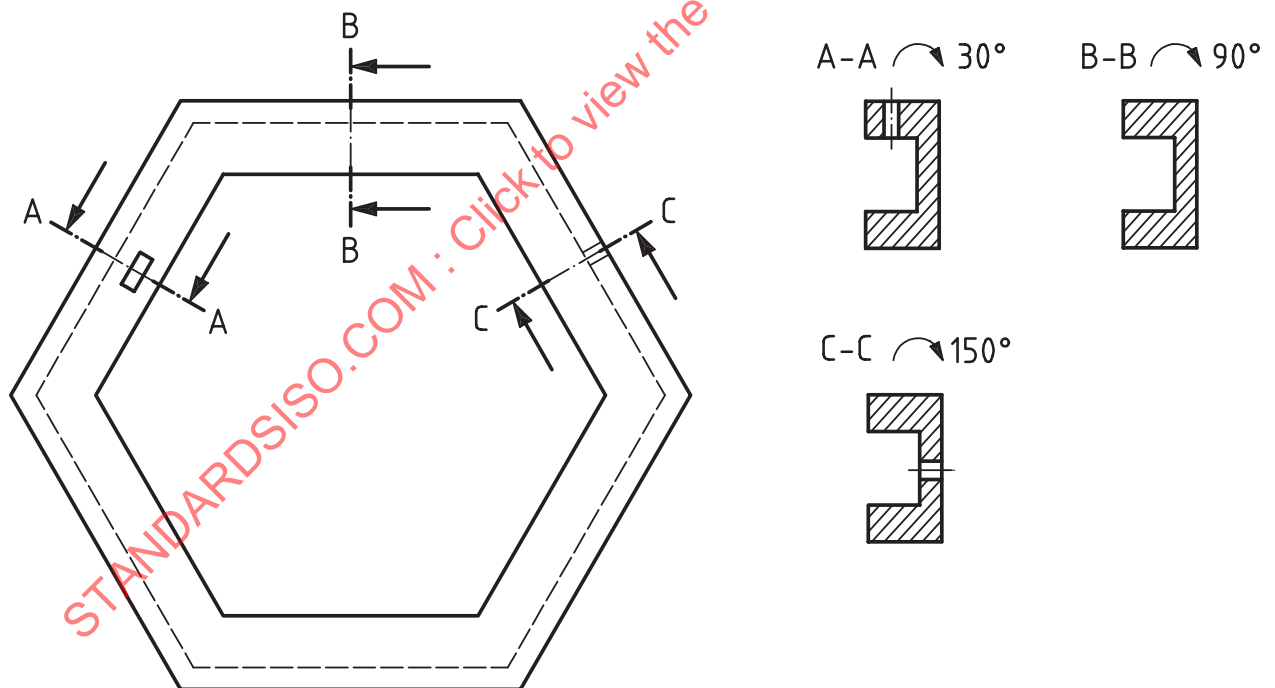


Figure B.4 — Successive sections

Annex C (normative)

Views on mechanical engineering technical drawings

C.1 Field of application

This annex specifies rules for the representation of views additional to the main clauses and applicable to mechanical engineering technical drawings that follow the orthographic projection methods specified in ISO 5456-2. Attention has also been given to reproduction requirements, including those of microcopying according to ISO 6428.

C.2 Types of lines and their application

The basic types of lines referred to in this document are specified in ISO 128-2. General rules and basic conventions for their application on mechanical engineering technical drawings are specified in ISO 128-2:—, Annex D.

C.3 Local views

Provided representation is unambiguous, a local rather than a complete view of symmetrical parts is permitted. Local views should be drawn in third-angle projection, regardless of the arrangement used for the general execution of the technical drawing. Local views shall be drawn with continuous wide lines (type 01.2) and connected to principal views by long-dashed dotted narrow lines (type 04.1). Examples are shown in [Figures C.1 to C.4](#).

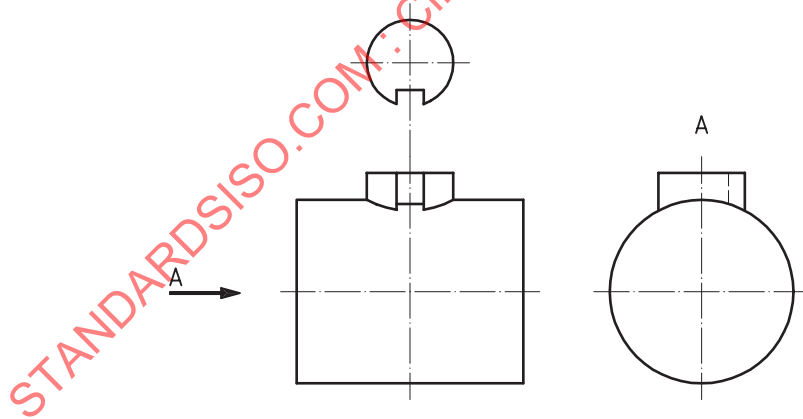


Figure C.1 — Local view of journal

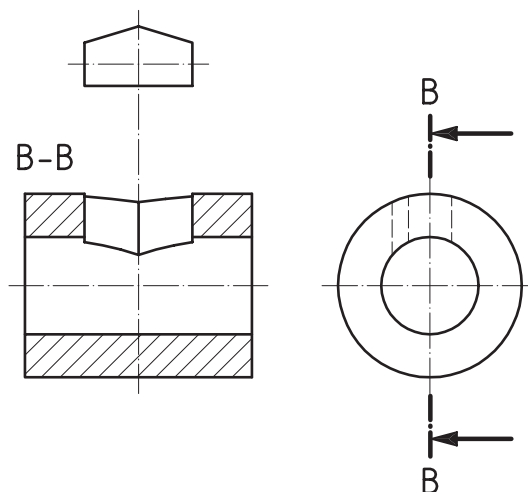


Figure C.2 — Local view of groove

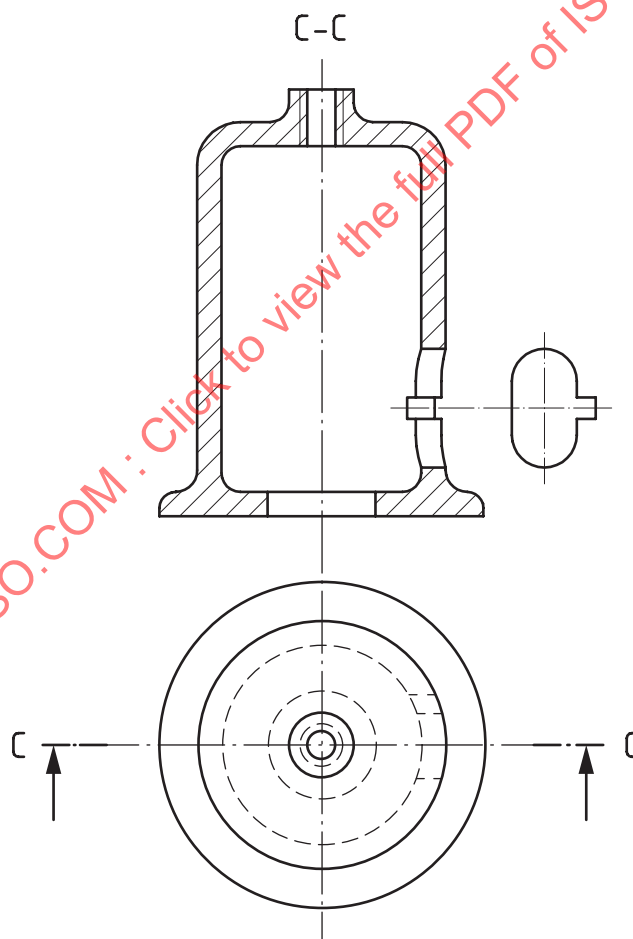


Figure C.3 — Local view of hole

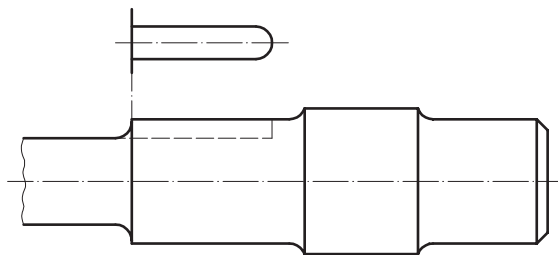


Figure C.4 — Local view of groove

C.4 Adjacent parts and contours

Where parts adjacent to an object are presented, they shall be drawn with long-dashed double-dotted narrow lines (type 05.1). The adjacent part shall not hide the principal part but can be hidden by it (see [Figure C.5](#) and [Figure C.6](#)). Adjacent parts in cuts and sections shall not be hatched.

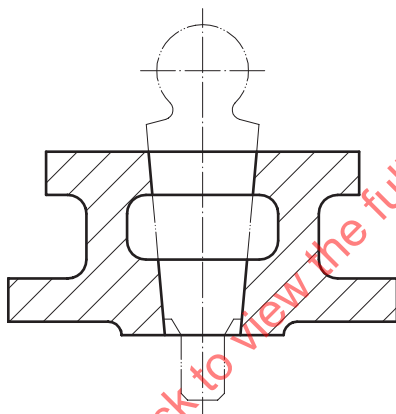


Figure C.5 — Bounded adjacent part

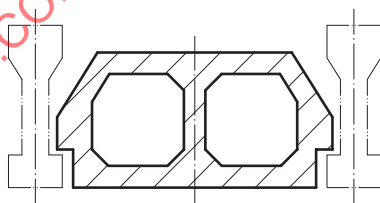


Figure C.6 — Adjacent parts

When the contours of features are not definitively delineated, the area presumed to enclose them shall be indicated by long-dashed double-dotted narrow lines (type 05.1), as in [Figure C.7](#) and [Figure C.8](#).

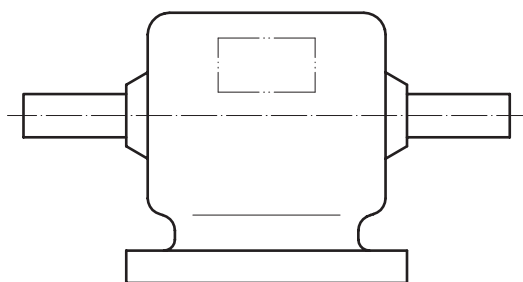


Figure C.7 — Indication of contours

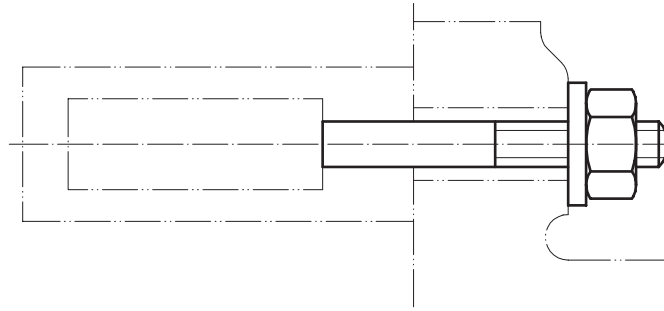


Figure C.8 — Indication of contours

C.5 Intersections

True geometric intersection lines shall be drawn with continuous wide lines (type 01.2) when visible, and with dashed narrow lines (type 02.1) when hidden (see [Figure C.9](#)).

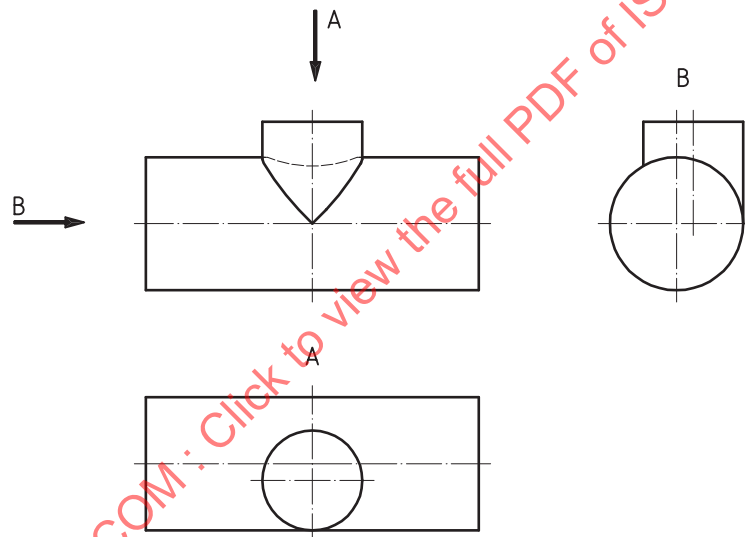


Figure C.9 — True intersection

Simplified representations of true geometric intersection lines may be applied at intersections as follows.

Between two cylinders the curved lines of intersection may be replaced by straight continuous wide lines (see [Figure C.10](#)).

Between a cylinder and a rectangular prism, the displacement of the straight line of intersection may be omitted (see [Figure C.2](#)).

However, the simplified representation should be avoided if it affects the intelligibility of the technical drawing.

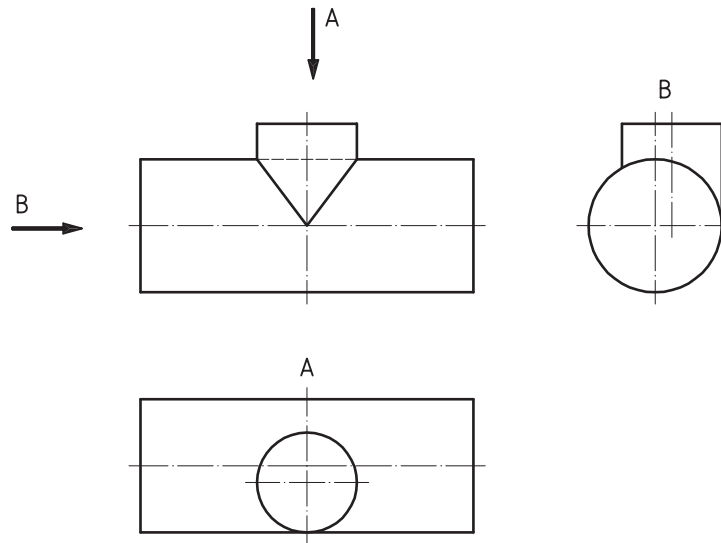


Figure C.10 — Simplified intersection

Imaginary intersection lines, such as fillets or rounded corners, can be indicated in a view by continuous narrow lines (type 01.1) (see [Figure C.11](#)).

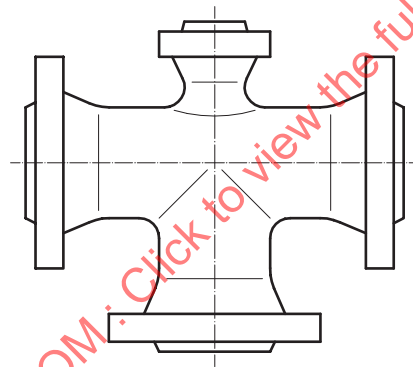


Figure C.11 — Imaginary intersections

C.6 Square ends on shafts

In order to avoid drawing a supplementary view, cut or section, square ends or flats ([Figure C.12](#)) or tapered square ends on shafts ([Figure C.13](#)) shall be indicated by diagonals drawn as continuous narrow lines (type 01.1).

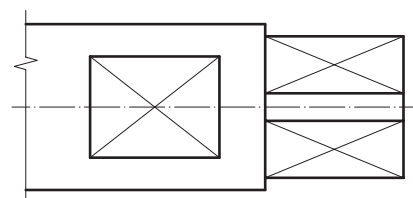


Figure C.12 — Square ends and flat

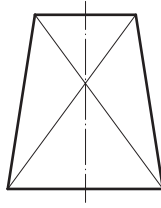


Figure C.13 — Tapered square end

C.7 Interrupted views

In order to save space, it is permissible to show only those portions of a long object needed for its definition. The limits of the parts retained shall be drawn as narrow, freehand or zigzag continuous lines. The portions shall be drawn close to each other (see [Figure C.14](#) and [Figure C.15](#)).

NOTE Interrupted views do not show the true geometry.

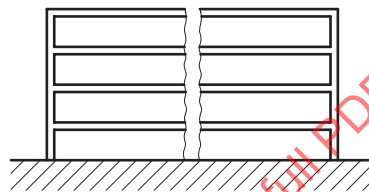


Figure C.14 — Interrupted view

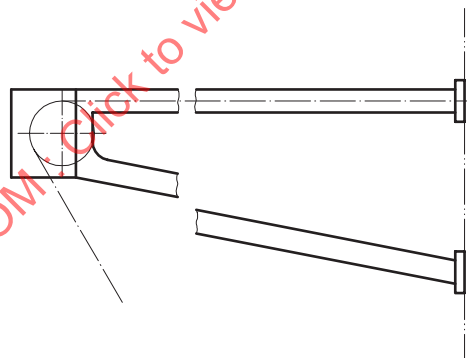


Figure C.15 — Interrupted view

C.8 Repeated features

If certain identical features occur in a regular order, only one of them and their locations need be illustrated. In all cases, the number and kind of repetitive features shall be defined by dimensioning according to ISO 129-1.

For symmetrical features, the location of the non-represented features is shown by long-dashed dotted narrow lines (type 04.1), as in [Figure C.16](#) and [Figure C.17](#). For asymmetrical features, the area of the non-represented features is identified by continuous narrow lines (type 01.1) as shown in [Figure C.18](#).

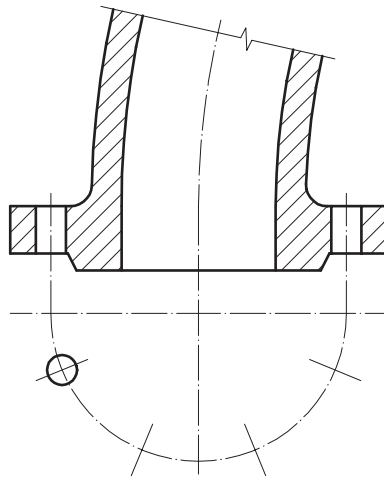


Figure C.16 — Symmetrical repeated features (in a local view)

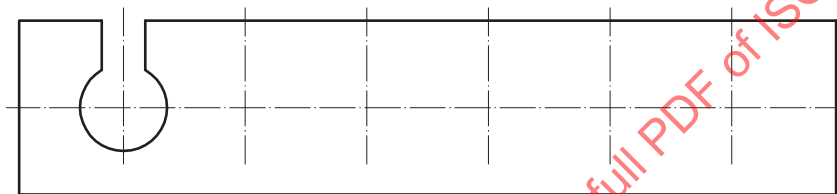


Figure C.17 — Symmetrical repeated features



Figure C.18 — Asymmetrical repeated features

C.9 Initial outlines

When it is necessary to depict initial outlines of a part prior to forming, these shall be indicated by long-dashed double-dotted narrow lines (type 05.1), as shown in [Figure C.19](#).

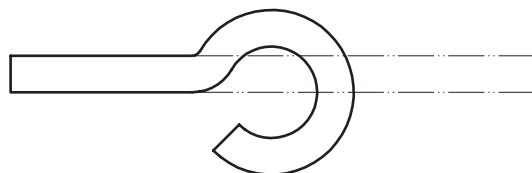
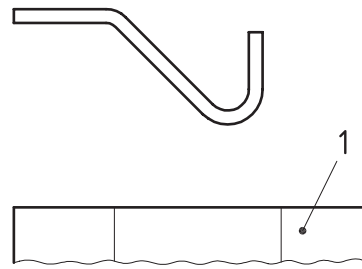


Figure C.19 — Initial outlines

C.10 Bend lines

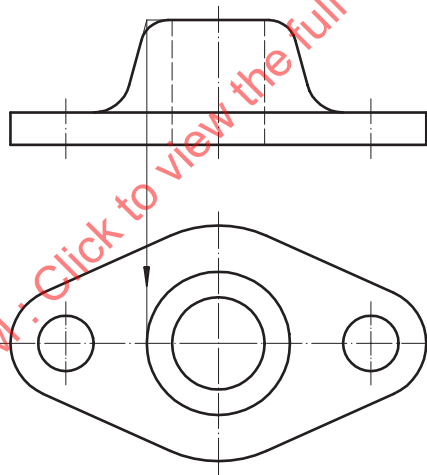
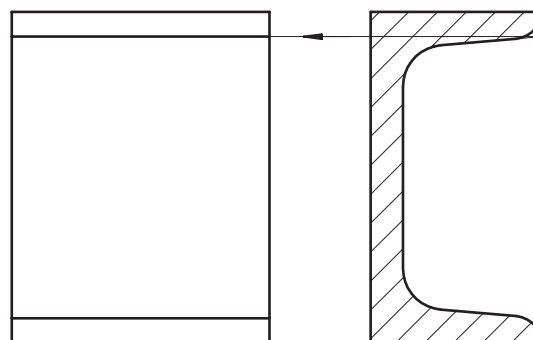
Bend lines in developed views shall be represented by continuous narrow lines (type 01.1), as shown in [Figure C.20](#).

**Key**

1 developed view

Figure C.20 — Bend lines**C.11 Slight inclines or curves**

If slight inclines or curves (on angled surfaces, tapers or pyramids) are too slight to be clearly indicated in a projection, their representation can be dispensed with. In such cases, only the edge corresponding to the projection of the smaller dimension shall be drawn as a continuous wide line (type 01.2). This is indicated by the projection lines in [Figure C.21](#) and [Figure C.22](#), which are drawn by way of explanation only.

**Figure C.21 — Slight curve****Figure C.22 — Slight incline**

C.12 Transparent objects

All objects made of transparent material shall be drawn as if not transparent (see [Figure C.23](#)).

Within assembly and general-assembly technical drawings, parts behind transparent parts may be drawn visible (see [Figure C.24](#)).

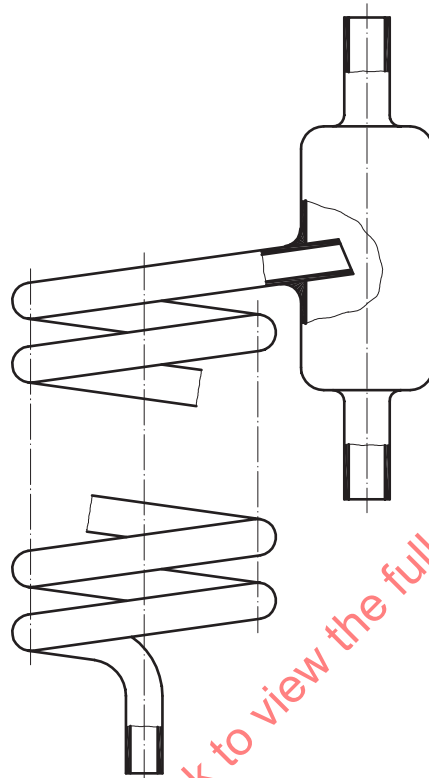


Figure C.23 — Transparent object

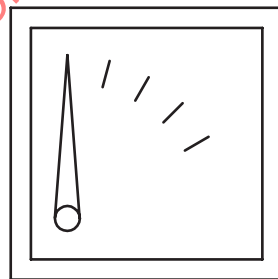


Figure C.24 — Assembly of transparent object

C.13 Movable parts

In assembly technical drawings the alternative and extreme positions of movable parts may be shown, drawn with long-dashed double-dotted narrow lines (type 05.1), as in [Figure C.25](#).

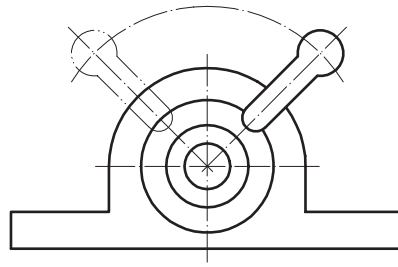


Figure C.25 — Movable part

C.14 Finished parts and blanks

It is permitted to show the shape of a finished part within the technical drawing of a blank, or the shape of the blank within the technical drawing of a finished part. These parts shall be drawn using long-dashed double-dotted narrow lines (type 05.1) (see [Figure C.26](#) and [Figure C.27](#)).

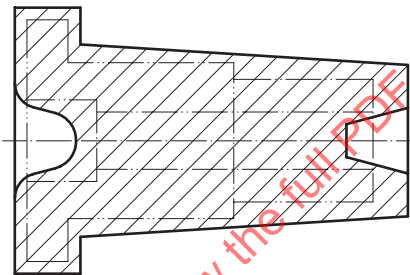


Figure C.26 — Finished part indicated in blank

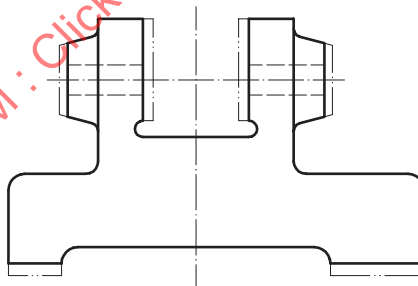


Figure C.27 — Blank indicated in finished part

C.15 Parts made from separate, equal elements

Parts made from separate, but equal, elements should be represented as homogeneous. The location of the elements may be indicated by short continuous narrow (type 01.1) lines, as shown in [Figure C.28](#).

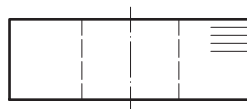


Figure C.28 — Separate, equal elements

C.16 Surface pattern

The structure of knurling, corrugation, fluting, mesh or lattice shall be represented completely or partly by continuous wide lines (type 01.2) (see [Figure C.29](#)).

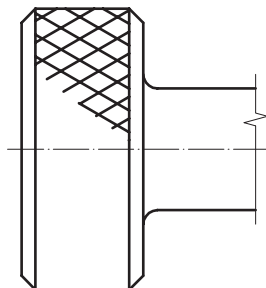


Figure C.29 — Surface pattern

C.17 Fibre and rolled directions

The fibre and rolled directions need not be shown in the representation of a part but, if necessary, may be indicated by short continuous narrow (type 01.1) lines with arrowheads, as illustrated in [Figure C.30](#) and [Figure C.31](#).

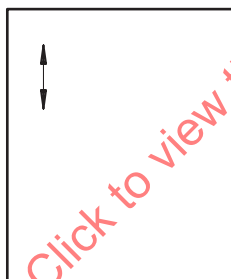


Figure C.30 — Fibre direction

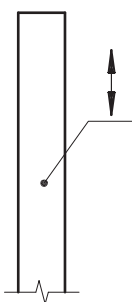


Figure C.31 — Rolled direction

C.18 Parts with two or more identical views

Two or more equal views on any one part can be identified by the indication “symmetrical part” (see [4.4](#)) or by reference arrows and capital letters or numerals, or both, as in [Figure C.32](#) and [Figure C.33](#).

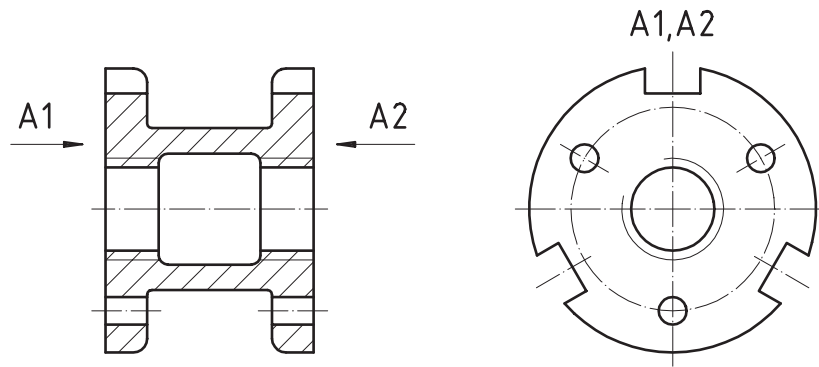


Figure C.32 — Two identical views

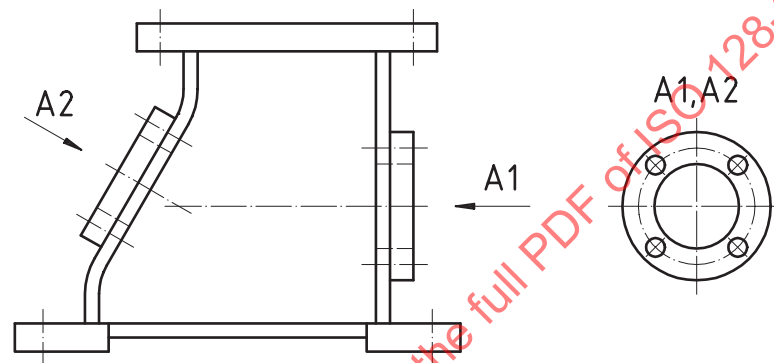
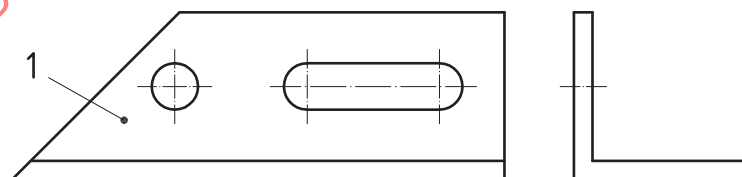


Figure C.33 — Two identical local views

C.19 Mirror-image parts

When simple parts are identical mirror images, a single representation shall suffice for both, provided that no errors can arise in manufacture as a result. An explanatory note shall be placed near the title block. See [Figure C.34](#).

If necessary, simplified representations of the two parts drawn on a reduced scale without dimensioning may be provided for emphasis.



Key

1 part 1

EXAMPLE (In title block) "Part 1, as drawn; part 2, identical mirror image."

Figure C.34 — Mirror-image parts

Annex D (normative)

Sections on mechanical engineering technical drawings

D.1 Field of application

This annex specifies general principles for presenting sections on mechanical engineering technical drawings following the orthographic projection methods specified in ISO 5456-2. For areas on sections, representation is according to [Clause 7](#).

Attention has also been given to the requirements of reproduction, including microcopying in accordance with ISO 6428.

NOTE The basic rules for cuts and sections are given in [Clause 6](#).

D.2 General

In principle, ribs, fasteners, shafts, spokes of wheels and the like are not cut in longitudinal sections and should therefore not be represented as sections.

Like views, sections may be shown in a position other than that indicated by the arrows for the direction of their viewing.

D.3 Cutting planes

A section or cut in one plane is shown in [Figure D.1](#) and [Figure D.2](#).

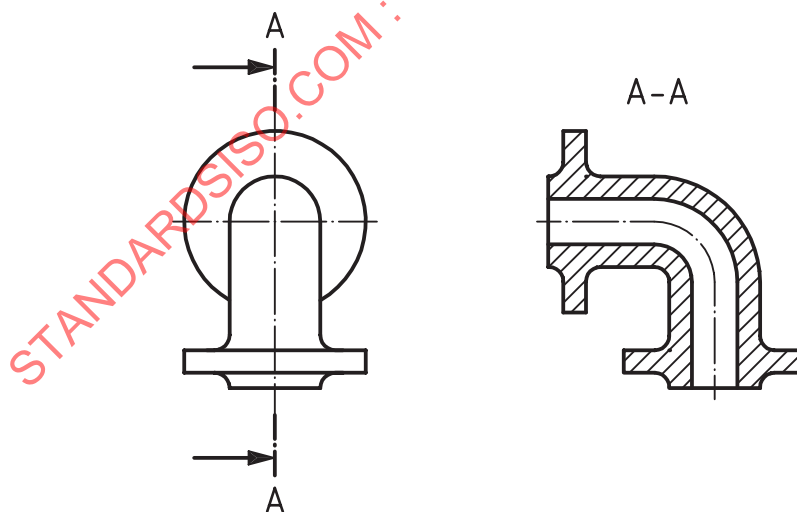


Figure D.1 — Section or cut in one plane

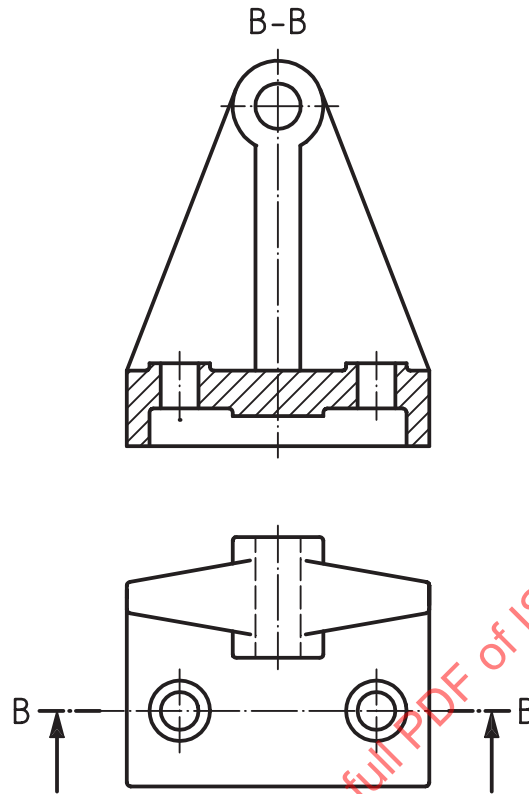


Figure D.2 — Section or cut in one plane

A section or cut in two parallel planes is shown in [Figure D.3](#).

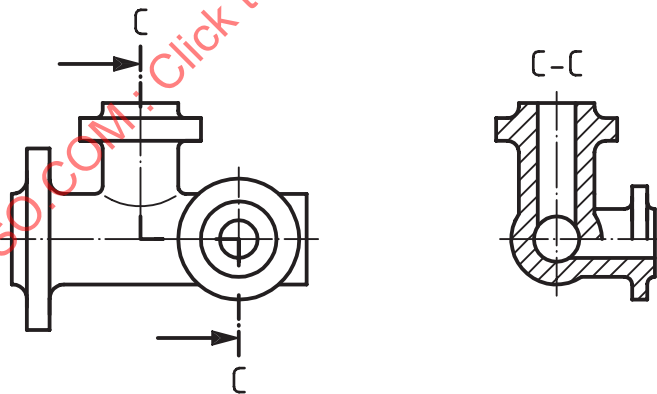


Figure D.3 — Section or cut in two parallel planes

A section or cut in three contiguous planes is shown in [Figure D.4](#).

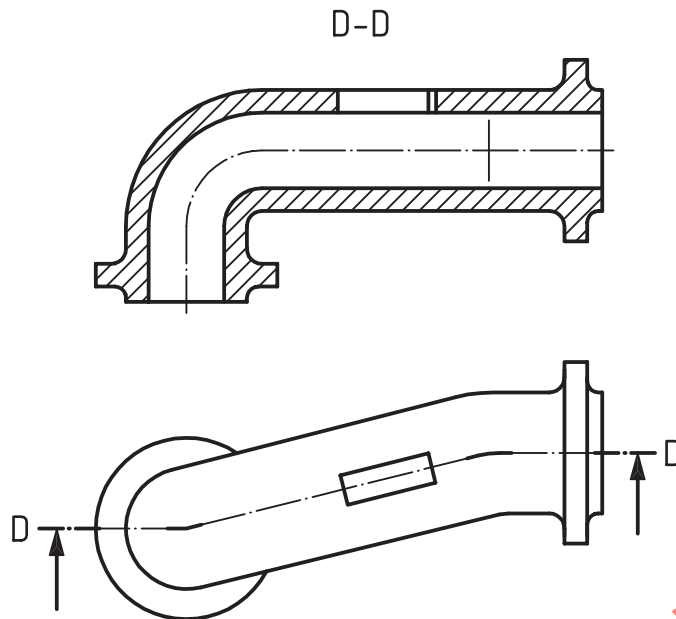


Figure D.4 — Section or cut in three contiguous planes

A section or cut in two intersecting planes, one revolved into the plane of projection, is shown in [Figure D.5](#).

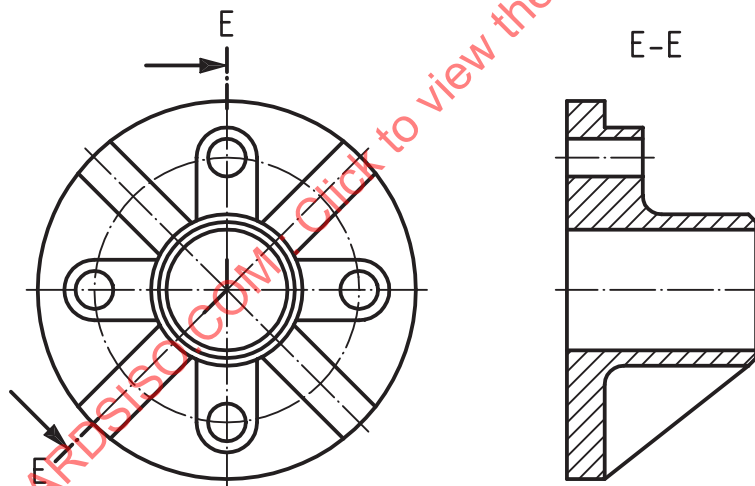


Figure D.5 — Section or cut in two intersecting planes

It is sometimes necessary to position the cutting plane partly outside the object; it is not, however, necessary to show the long-dashed dotted narrow line of type 04.1 specified in ISO 128-2:—, (see [Figure D.6](#)).

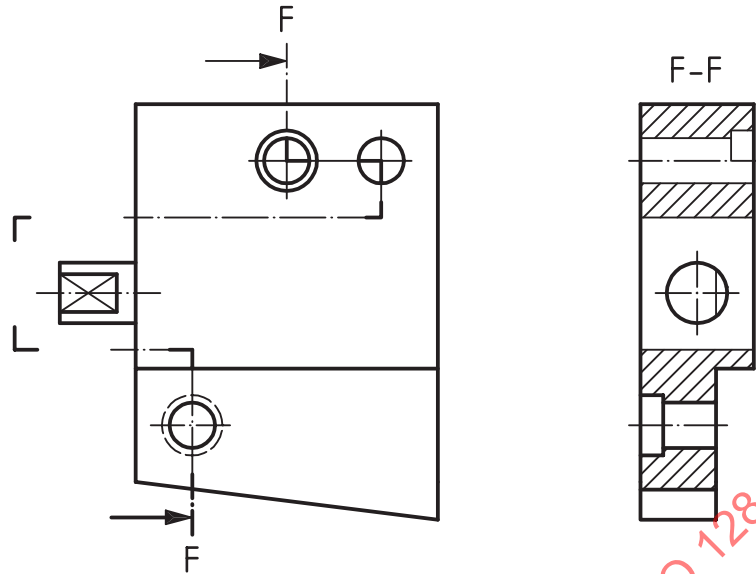


Figure D.6 — Cutting plane positioned partly outside object

D.4 Removed sections

When sections are removed from a view, they shall be placed near that view and connected to it by the long-dashed dotted narrow line of type 04.1 specified in ISO 128-2:—, (see [Figure D.7](#)).

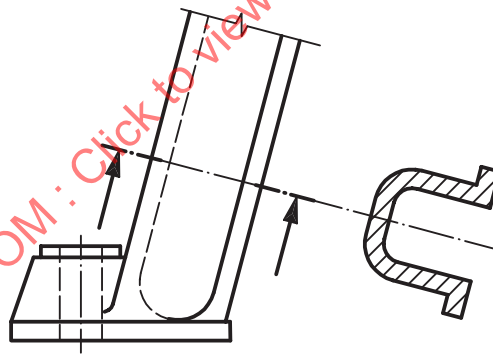


Figure D.7 — Section removed from a view

D.5 Other sections

For sections revolved in the relevant view, as well as for sections of symmetrical parts and local sections, see [Clause 6](#).

D.6 Arrangement of successive sections

Successive sections can be arranged in a manner similar to the examples shown in [Figures D.8](#) to [D.10](#), in as much as it is suitable for the layout and understanding of the technical drawing.

Unless they contribute to the clarification of the technical drawing, outlines and edges behind the cutting plane may be omitted.

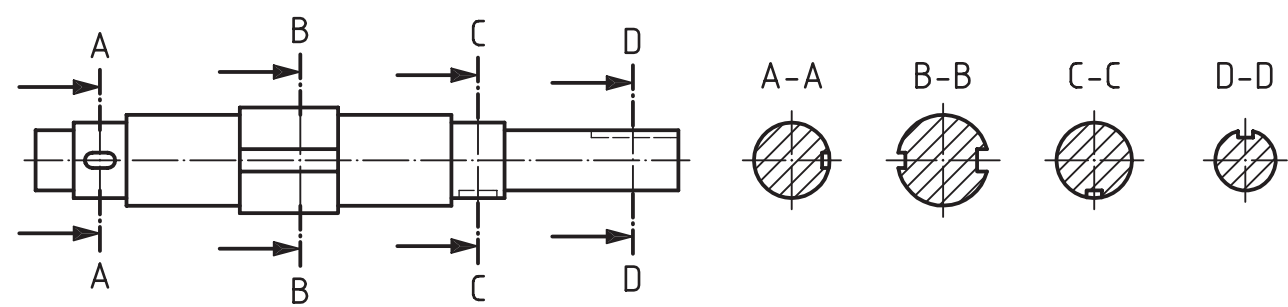


Figure D.8 — Successive sections or cuts — Example 1

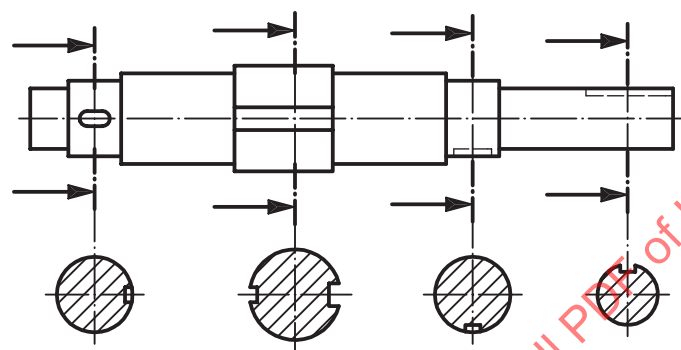


Figure D.9 — Successive sections or cuts — Example 2

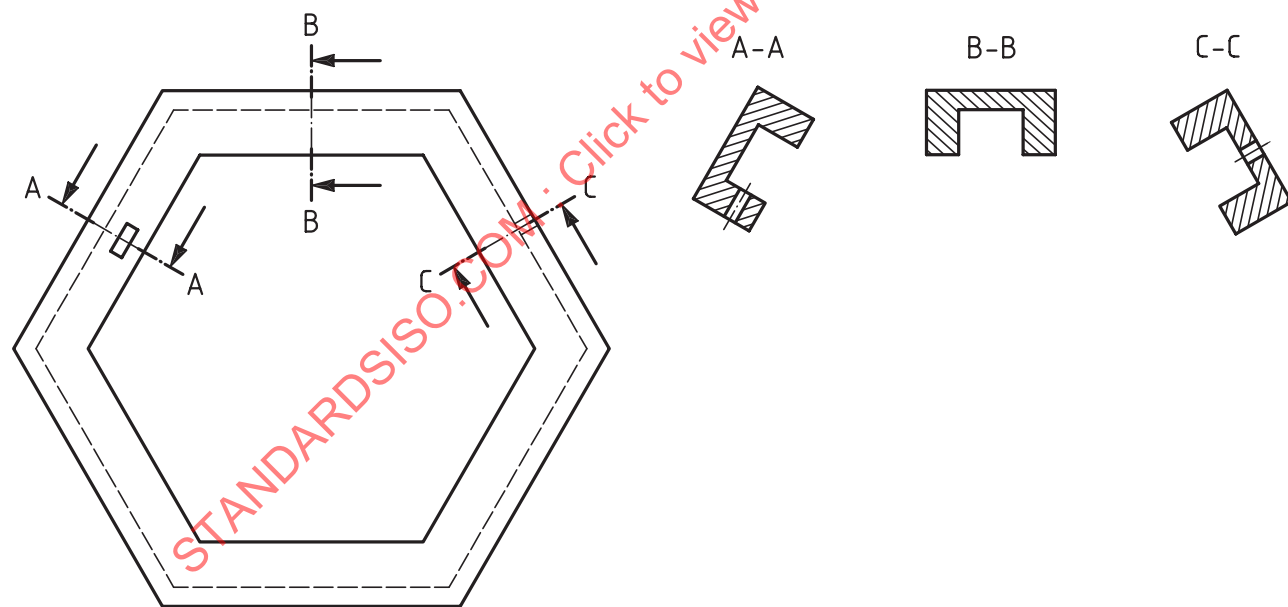


Figure D.10 — Successive sections — Example 3