



BSI Standards Publication

Technical product documentation (TPD) — Presentation of dimensions and tolerances

Part 1: General principles

National foreword

This British Standard is the UK implementation of EN ISO 129-1:2019+A1:2021. It is identical to ISO 129-1:2018, incorporating amendment 1:2020. It supersedes BS EN ISO 129-1:2019, which is withdrawn.

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

A list of organizations represented on this committee can be obtained on request to its committee manager.

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31 October 2019	This corrigendum renumbers BS ISO 129-1:2018 as BS EN ISO 129-1:2019
31 January 2021	Implementation of ISO amendment 1:2020 with CEN endorsement A1:2021: addition of new subfigures c) and d) to Figure 39

English Version

Technical product documentation (TPD) - Presentation of
dimensions and tolerances - Part 1: General principles -
Amendment 1 (ISO 129-1:2018/Amd 1:2020)

Documentation technique de produits -
Représentation des dimensions et tolérances
- Partie 1: Principes généraux - Amendement
1 (ISO 129-1:2018/Amd 1:2020)

Technische Produktdokumentation (TPD) - Angabe
von Maßen und Toleranzen - Teil 1: Grundlagen
- Änderung 1 (ISO 129-1:2018/Amd 1:2020)

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European foreword

The text of ISO 129-1:2018 has been prepared by Technical Committee ISO/TC 10 "Technical product documentation" of the International Organization for Standardization (ISO) and has been taken over as EN ISO 129-1:2019 by CCMC.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2020, and conflicting national standards shall be withdrawn at the latest by April 2020.

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Endorsement notice

The text of ISO 129-1:2018 has been approved by CEN as EN ISO 129-1:2019 without any modification.

Foreword to amendment A1

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This Amendment to the European Standard EN ISO 129-1:2019 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 2021, and conflicting national standards shall be withdrawn at the latest by July 2021.

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Endorsement notice

The text of ISO 129-1:2018/Amd 1:2020 has been approved by CEN as EN ISO 129-1:2019/A1:2021 without any modification.

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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).

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

For an explanation on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 10, *Technical product documentation*.

This second edition cancels and replaces the first edition ([ISO 129-1:2004](http://www.iso.org/iso/129-1:2004)), which has been technically revised.

The main changes compared to the previous edition are as follows:

- that this document does not cover the application of dimensioning tolerances has been clarified;
- property indicator, surface indicator, developed length and between symbols have been discussed;
- flag notes and textual instructions have been discussed;
- dimensioning repeated features and restricted areas have been clarified.

A list of all parts in the ISO 129 series can be found on the ISO website.

Introduction

This document is intended for all fields of application. See other parts of ISO 129 for information pertaining to specific application areas.

The principles of tolerancing and the interpretation of tolerance presentations are given in the ISO 14405 series.

Figures in this document illustrate the rules and are not intended to show complete representations. It should be understood that third-angle projection could equally well have been used without prejudice to the principles established.

Technical product documentation (TPD) — Presentation of dimensions and tolerances —

Part 1: General principles

1 Scope

This document establishes the general principles for presentation of dimensions and associated tolerances that apply to 2D technical drawings in all disciplines and trades but which can also be applied to 3D applications.

This document does not cover the application of dimensional tolerances and their meaning. See [ISO 14405-1](#) for tolerancing principles. This document can only be used to describe the nominal model of a drawing, not the non-ideal surface model (skin model) used for tolerancing purposes (for more information on tolerancing specifications, see the list of GPS standards listed as normative reference or as bibliography)

Considering the ISO 14405 series, the presentation of tolerance indication is unambiguous when it is applied to a dimension which is a size and ambiguous when the dimension is not a size.

All rules presented in this document are available for any type of drawing (see [ISO 29845](#)).

In addition, this document introduces the concept of property indicators, developed length, between, surface indicators, flag notes and textual instructions.

NOTE 1 All figures are shown in 2D views only.

NOTE 2 Additional information and details for construction engineering are given in [ISO 6284](#).

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 128-20](#), *Technical drawings — General principles of presentation — Part 20: Basic conventions for lines*

[ISO 128-22](#), *Technical drawings — General principles of presentation — Part 22: Basic conventions and applications for leader lines and reference lines*

[ISO 128-24:2014](#), *Technical drawings — General principles of presentation — Part 24: Lines on mechanical engineering drawings*

ISO 3098 (all parts), *Technical product documentation — Lettering*

[ISO 10209](#), *Technical product documentation — Vocabulary — Terms relating to technical drawings, product definition and related documentation*

ISO 14405 (all parts), *Geometrical product specifications (GPS) — Dimensional tolerancing*

[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](#) and the following apply.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1 Elements of dimensioning

3.1.1

centre line

line or set of two perpendicular lines used to represent a median feature, e.g. an axis or a centre plane

3.1.2

dimension line

straight or curved line with terminators at each end or origin and terminator at each end, indicating the size of a feature or the extent of a feature or between two features, or between a feature and an *extension line* ([3.1.3](#)), or between two extension lines

3.1.3

extension line

line which is an extension of a feature outline or of a *centre line* ([3.1.1](#))

3.1.4

origin symbol

circle indicating the start of running dimensioning or coordinate dimensioning

3.2 Dimensions

3.2.1

angular dimension

angle of an angular feature of size or angle between two features

Note 1 to entry: In mechanical engineering drawings, angular dimensions are classified as angular sizes or angular distances; see [ISO 14405-2](#).

3.2.2

dimensional value

nominal numerical value expressed in a specific unit relevant to a *linear* or *angular dimension* ([3.2.4](#), [3.2.1](#))

Note 1 to entry: The tolerance limits and/or permissible deviations are applied to the dimensional value.

3.2.3

developed length

initial length of material prior to forming, e.g. by bending

3.2.4

linear dimension

linear size of a feature of size or a linear distance between two features

Note 1 to entry: In mechanical engineering drawings, linear dimensions are classified as linear sizes or linear distances; see [ISO 14405-2](#).

3.2.5

property indicator

symbol used to define the shape of a feature or property of an entity composed by several features

4 Presentation of dimensions

4.1 Presentation rules

4.1.1 Dimensions

Only the dimensions necessary to unambiguously define the nominal geometry (nominal model) shall be presented. Each dimension shall be presented only once by using a dimension line, a dimension value preceded, and if necessary, by a property indicator. When there is a need to repeat the presentation of a dimension, auxiliary dimensions may be used.

Dimensional values indicated in decimal notation, shall use a comma as the decimal marker.

Unless otherwise specified, dimensions shall be indicated for the finished state of the dimensioned feature.

The text of all dimensions, graphical symbols and annotations shall be indicated above the dimension line and read from the bottom. When the text of a dimension, symbol or annotation is presented vertically, it shall read from the right. The determination of orientation is based on the centre of the dimension, symbol or annotation.

Dimensions alone are not sufficient to define the requirements of a product. Dimensions shall be used with other specification techniques as applicable, e.g. general tolerances, geometrical tolerancing or surface texture requirements.

4.1.2 Repeated dimensions

When a feature is repeated on the drawing, it is possible to simplify the indication of its dimension on the drawing by indicating:

- on one instance of the feature, the nominal dimension (with a property indicator symbol if appropriate), preceded by the associated number of repetition, followed by a multiplication symbol ($\times$) and a space (e.g. $2 \times \varnothing 18$) (see [Figure 10](#)). To avoid confusion, it is possible to identify each member of the repetition using a reference identifier (e.g. letter or symbol) (see [Figure 64](#));
- a nominal dimension (with a property indicator symbol if appropriate) above a reference line, which is attached to each member of the repetition (see [Figures 49](#) and [50](#)).

4.1.3 Out of scale dimensions

By default, a dimension line is drawn to the scale of the drawing. In exceptional cases, in 2D drawing only, when the dimension value does not correspond to its dimension scale value (out-of-scale features), the dimension value shall be marked by underlining the dimensional value (see [7.11](#) and [Figure 70](#)).

4.1.4 Auxiliary dimensions

A dimension value can be defined as a dimension for information purposes only. In this case, the dimension value shall be placed into parenthesis, (). This kind of dimension is called an auxiliary dimension (see [7.12](#) and [Figures 65](#) and [66](#)).

4.1.5 Theoretically exact dimensions

When a dimension value shall be considered as a theoretical exact dimension and not associated with general $\pm$ tolerancing or not an auxiliary dimension, it shall be placed in a rectangular frame (in accordance with ISO 1101, [7.13](#) and [Figure 71](#)).

4.1.6 Symmetrical dimensions

When the design of a part has one or more symmetries, it is possible to represent a portion of the part which can allow reconstructing the complete part by symmetry (see 7.9). In this case, the dimensions, shown only on the portion and the dimension line between two symmetrical features, are indicated from the feature shown on the portion with a termination and cross perpendicularly the axis of symmetry without termination (see Figures 65 and 66).

4.1.7 Characters and presentation

Characters on drawings shall be in accordance with the ISO 3098 series.

There shall be only one character height for dimension and tolerance presentation for a specific drawing.

A space shall separate the elements of the dimension indicator (see Figures A.3 and A.4).

The dimension value and the lower deviation shall be at the same distance from the dimension line (see Examples 1 and 2).

When upper and lower tolerance limits are presented in two separate lines (e.g. limit deviations, dimension limit values), the decimal marker of the upper and lower shall be aligned. When a tolerance limit is not shown with a decimal marker, the remaining digits shall be aligned as if the decimal marker had been displayed (see Examples 1 and 2).

Trailing zeros may or may not be presented:

Example 1	Example 2
+0,20	0
2× 55 -0,15	2× 55 -0,15

Deviations shall always be presented with a “+” or “-” sign as appropriate, unless the value is zero, in which case, no sign shall be presented (see Example 2).

For tolerances attached to a dimension displayed in accordance with ISO 286-1, it is not necessary to express the values of the deviations unless they are needed (see Figure 1).

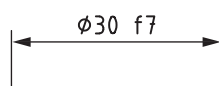


Figure 1

4.2 Positioning of dimensions

Dimensions shall be placed in a view or section which shows the relevant feature(s) most clearly (see Figure 2).

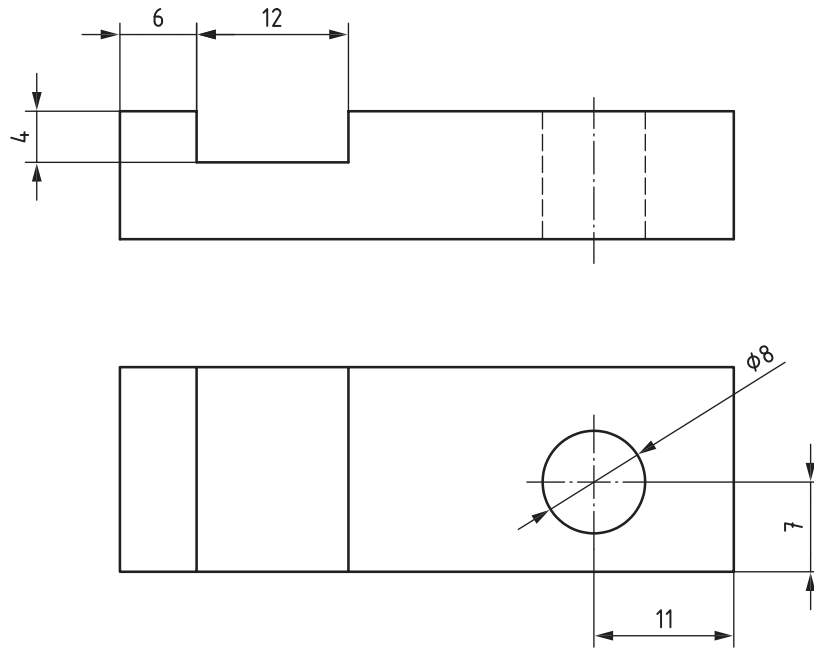


Figure 2

Dimension lines for internal features and dimension lines for external features shall, wherever possible, be arranged and indicated in separate groups of dimensions to improve readability (see [Figure 3](#)).

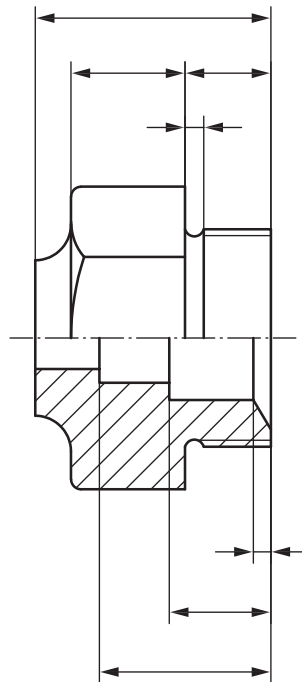


Figure 3

Where several features or objects are depicted in close proximity, their relative dimensions shall be grouped together, separately, for ease of reading (see [Figure 4](#)).

Whenever possible, dimensions should not be placed within the contour of the depicted item.

Dimensioning of hidden features is not recommended and should be avoided unless absolutely necessary and completely unambiguous.

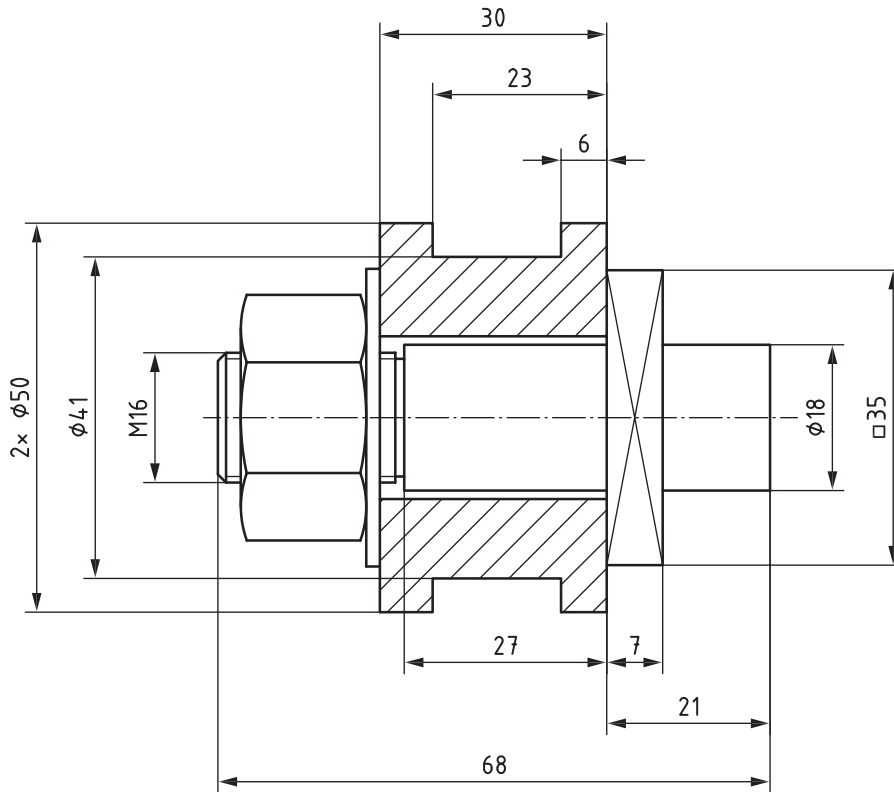


Figure 4

4.3 Units of dimensions

For linear units, the predominant unit on a drawing may be specified on the drawing or in an associated document and the unit omitted from the individual dimensions.

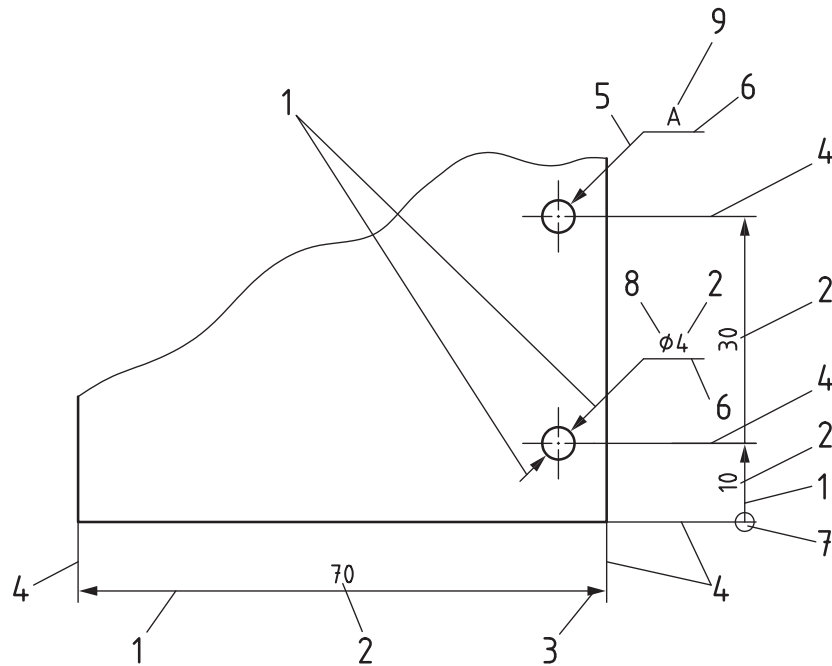
For angular dimensions, the units shall always be specified with the individual dimensions (see [Figure 7](#) and [Figures 34](#) to [37](#)).

Any dimensions expressed in a different unit of measure shall indicate that unit of measure.

5 Elements of dimensioning — Usage

5.1 General

Various elements of dimensioning are illustrated in [Figure 5](#).



Key

- 1 dimension line
- 2 nominal dimension value
- 3 terminator (in this case, an arrowhead)
- 4 extension line
- 5 leader line
- 6 reference line
- 7 origin symbol
- 8 property indicator
- 9 reference letter

Figure 5

5.2 Property indicators

Property indicator symbols (see [Table 1](#)) may be used to describe the shape of the feature and the type of associated dimension. The symbol shall precede the dimension without a space (see figures referenced in [Table 1](#)).

No property indicator is required for the presentation of

- linear dimensions between two parallel planes (see [Figure 9](#)), or two parallel straight lines (see [Figure 41](#)), or
- angular dimensions between two intersecting planes (see [Figures 7](#) and [59](#)) or two intersecting straight lines.

Table 1

Property indicator symbol	Description	Associated property	Example of presentation
ϕ	Diameter	Cylindrical feature or circular feature described by its diameter.	Figures 2, 6 and 10

Property indicator symbol	Description	Associated property	Example of presentation
R	Radius	Cylindrical feature or circular feature described by its radius.	Figures 8 and 44
□	Square	Square feature with four equal angles and four equal sides described by its side dimension.	Figures 4 , 55 to 57
S∅	Spherical diameter	Spherical feature described by its diameter.	Figure 51
SR	Spherical radius	Spherical feature described by its radius.	Figure 52
	Arc length	Curvilinear dimension of non-flat feature (e.g. arc length).	Figures 8 , 53 and 54
t=	Thickness (of thin objects)	Two offset features defined by its thickness.	Figure 78
	Depth	Depth of a hole or internal feature.	Figures 39 and 41
	Cylindrical counterbore	Cylindrical hole with a flat bottom described by its diameter and depth.	Figure 39
	Countersink	Circular chamfer described by a diameter and angle.	Figure 40
	Developed length	Length of feature prior to bending or forming.	Figure 77
	Between	Indication of the extent of a restricted area, used in conjunction with reference letters.	Figures 54 and 81

5.3 Dimension line

Dimension lines shall be indicated as continuous narrow lines according to [ISO 128-20](#).

Dimension lines shall be indicated in the case of:

- linear dimension:
 - which is a size of a feature of size indicated by a single dimension line (see [Figures 6](#) and [27](#));
 - which is radius generated from the geometrical centre of the circle of which the arc is part and leading to the outline of the arc (see [Figure 8](#));
 - which is a distance between two features or an extent of restricted area parallel to the length to be dimensioned (see [Figures 10](#) and [83](#));
- angular dimensions or dimensions of an arc as a circular arc around the vertex of the angle or the centre of the arc (see [Figures 7](#) and [8](#)).

Where space is limited, dimension lines may be extended past the extension lines and the arrowheads placed outside of the extension lines and reversed (see [Figure 2](#)).

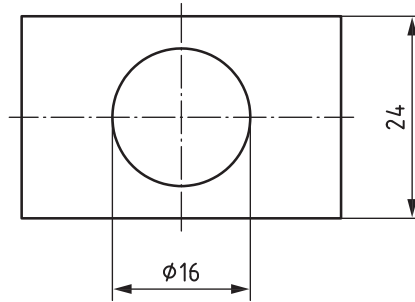


Figure 6

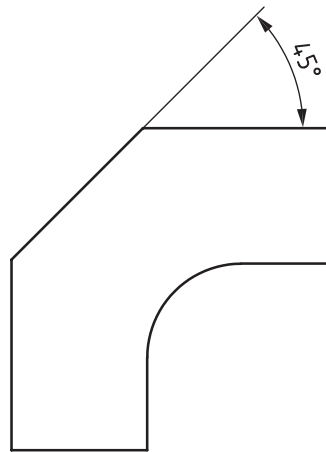


Figure 7

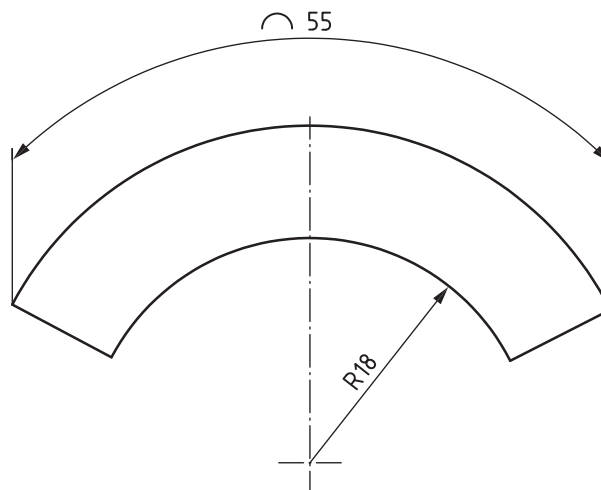


Figure 8

Where the feature is shown broken, the corresponding dimension line shall be shown unbroken (see [Figure 9](#)).

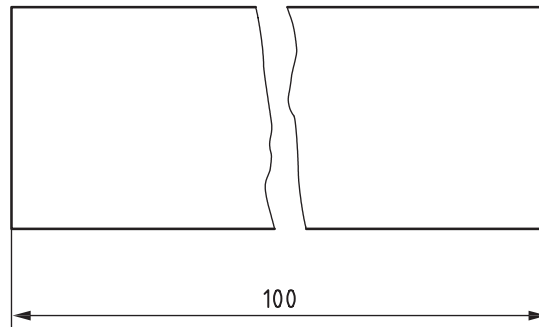


Figure 9

Dimension lines of circular features may be indicated obliquely through the centre of the feature (see [Figure 10](#)).

Intersection of dimension lines with any other line should be avoided, but where intersection is unavoidable, they shall be shown unbroken (see [Figure 10](#)).

Centre lines and the outlines of a feature shall not be used as dimension lines.

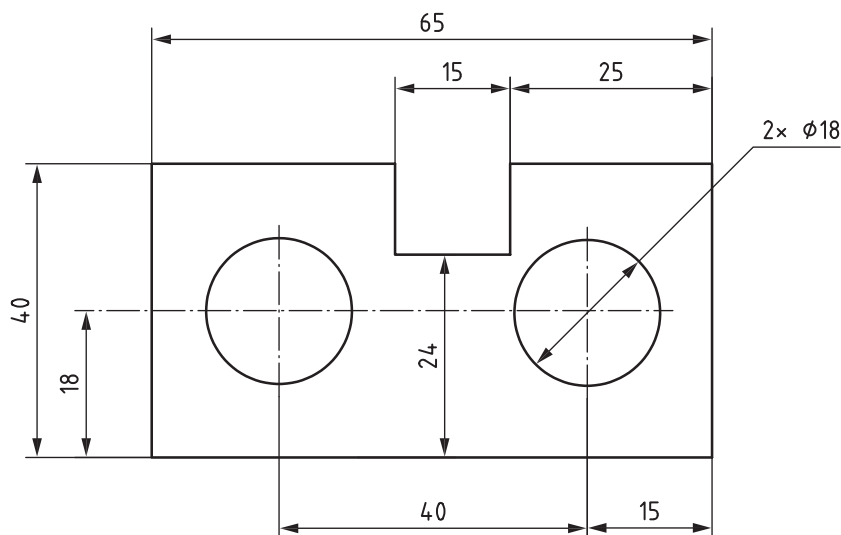


Figure 10

Dimension lines may be shown not in full, when:

- dimensions of diameters are indicated (see [Figure 11](#));
- a part of a symmetrical feature is drawn in a view or section (see [Figures 65](#) and [67](#));
- the reference feature for dimensioning is not on the drawing sheet and there is no need for its presentation (see [Figure 45](#), R140);
- simplified running dimensioning is used [see [Figure 90](#) b)].

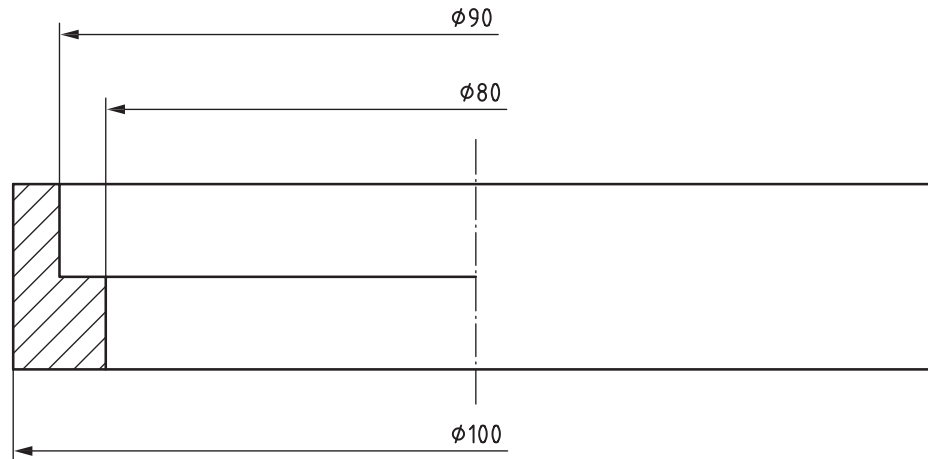


Figure 11

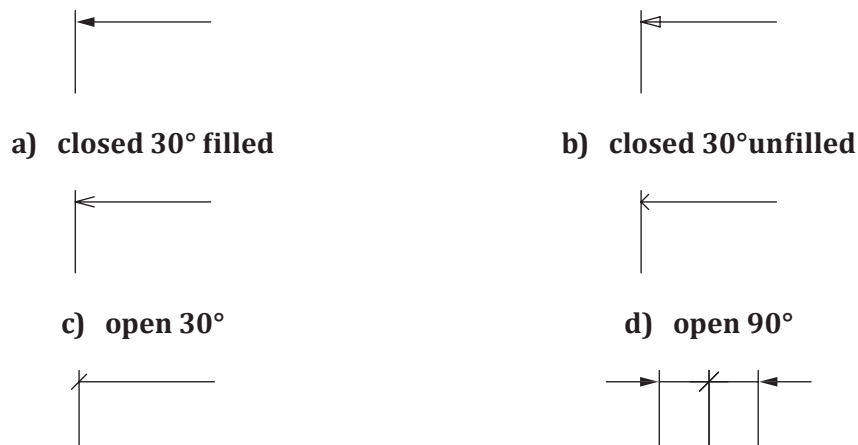
5.4 Terminators and origin presentation

5.4.1 Terminators

Terminators shall be shown according to one of the following representations (see [Figure 12](#)):

- a) arrowheads: when an arrowhead is shown, it shall be one of the following types (only one type of arrowhead shall be used on a single drawing or set of drawings):
 - 1) closed 30° filled, [Figure 12 a](#));
 - 2) closed 30° unfilled, [Figure 12 b](#));
 - 3) open 30°, [Figure 12 c](#));
 - 4) open 90°, [Figure 12 d](#));
- b) oblique stroke, [Figure 12 e](#)) and f);
- c) point, [Figure 12 g](#)).

[Figures 12 c](#)) and d) terminators shall not be used for mechanical engineering purposes.



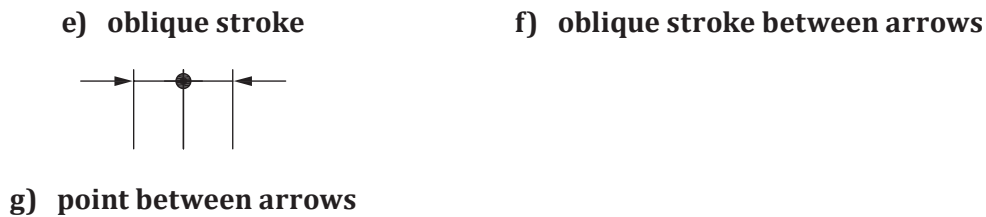


Figure 12

The size ratios of the terminators illustrated in [Figure 12](#) shall be in accordance with [Annex A](#). Where space is available, the arrowhead terminators shall be shown between the extension lines (see [Figure 14](#)). Where space is limited, the arrowhead termination may be

- shown outside of the extension lines on an extended dimension line (see [Figure 26](#), dimension 1,5), or
- substituted with either points or oblique strokes (see [Figure 26](#), dimension 6), or
- substituted by the use of an opposing arrowhead or other terminator from another dimension line (see [Figure 26](#), dimension 3, [Figure 83](#) and [Figure 100](#), dimension 5).

5.4.2 Origin presentation

The origin symbol may be used for

- the origin for running dimensioning (see [8.4](#)), or
- the origin of a coordinate system for coordinate dimensioning (see [8.5](#)).

The origin symbol shall be indicated on the dimension line at the location where a specific dimension or multi dimensions start (see [Figures 13](#) and [96](#)).

The size ratios of the origin circle illustrated in [Figure 13](#) shall be in accordance with [Annex A](#).

NOTE The origin symbol does not change the meaning of dimensional tolerances and does not function as a datum.



Figure 13

5.5 Extension line

Extension lines shall be drawn as continuous narrow lines according to [ISO 128-20](#).

Extension lines should not be drawn between views and should not be drawn parallel to the direction of hatching.

Extension lines shall extend approximately eight times the line width beyond their associated dimension line.

Extension lines should be drawn perpendicular to the corresponding physical length (see [Figures 5](#), [6](#), [11](#), [14](#) and [15](#)).

For circular features, the extension line shall be drawn as a continuation of the feature shape (see [Figure 43](#), $\varnothing 60$).

It is permissible to have a gap, eight times the extension line width, between the feature and the beginning of the extension line (see [Figure 15](#)). Gaps can be used with any terminator.

The centre line or outline of a feature or their extensions may be used in place of an extension line (see [Figure 10](#)).

Where common extension lines are shown, i.e. between repeated features, they should be considered to be coincident (see [Figure 21](#)).

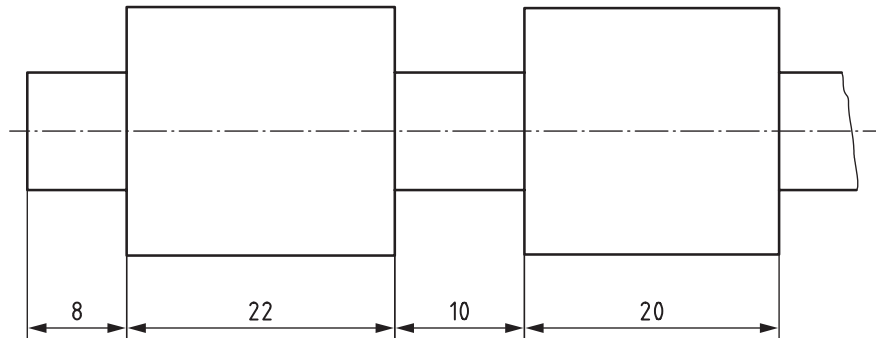


Figure 14

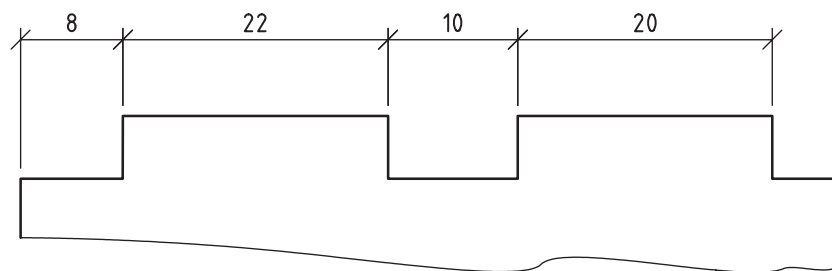


Figure 15

The extension lines may be drawn oblique to the feature but shall be parallel to each other (see [Figure 16](#)).

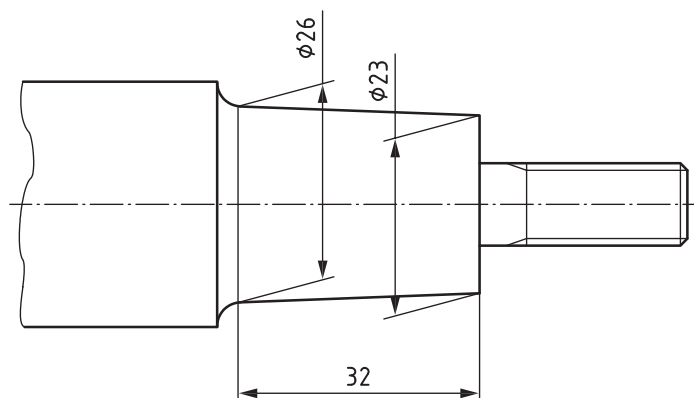


Figure 16

When dimensioning, intersecting projected contours of outlines shall extend approximately eight times the line width beyond the point of intersection (see [Figure 17](#)).

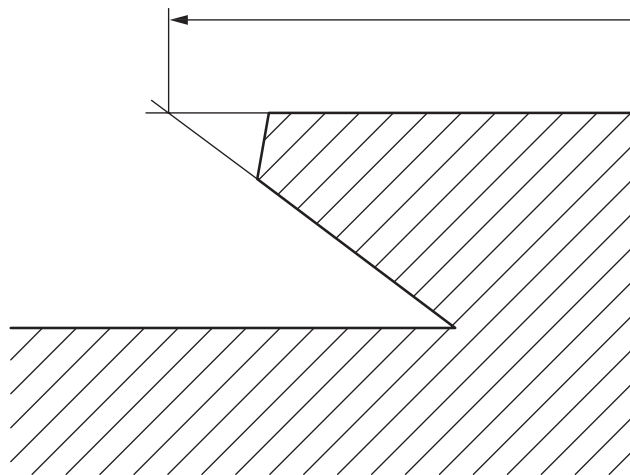


Figure 17

In the case of projected contours of transitions and similar features, the extension lines apply at the point of intersection of the projection lines (see [Figure 18](#)).

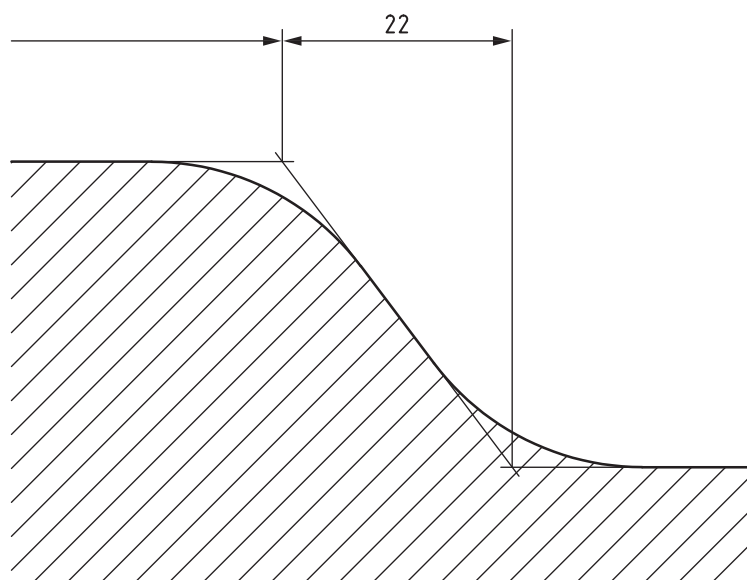


Figure 18

Extension lines may be interrupted if their continuation is unambiguous (see [Figures 19](#) and [20](#)). In the case of angular dimensions, the extension lines are the extensions of the angle legs (see [Figure 20](#)).

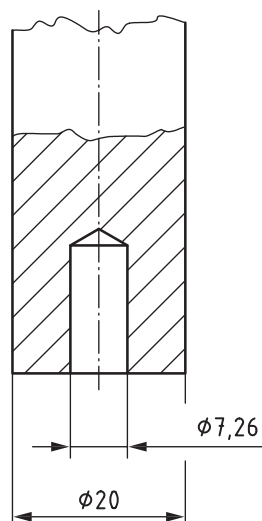


Figure 19

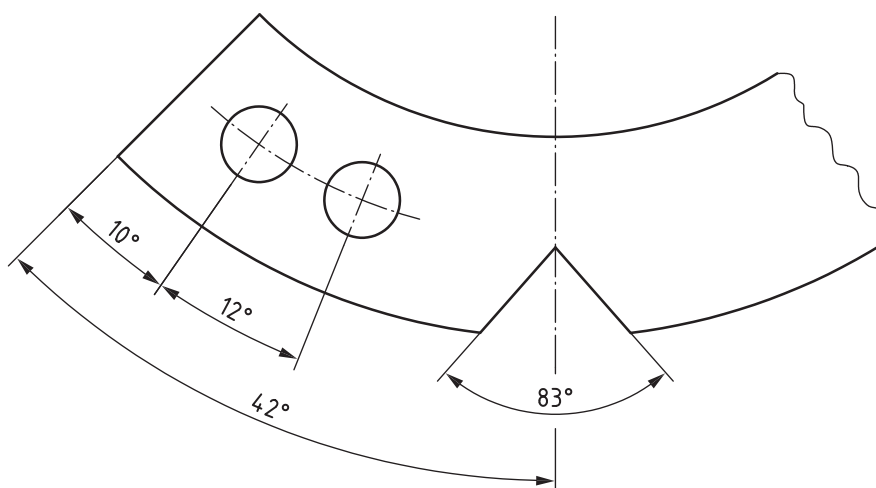
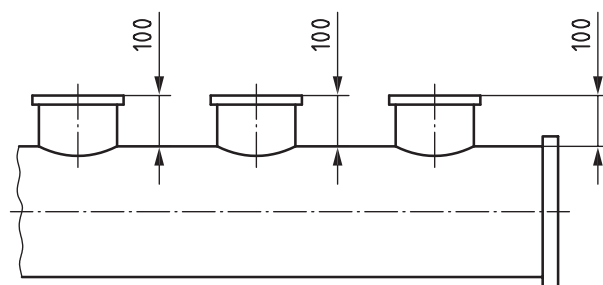


Figure 20

For repeated features, as an alternative to individual dimensions [see [Figure 21 a\)](#)] or using common extension lines which can be ambiguous [see [Figure 21 b\)](#)], the repeated feature dimension method “n×” as described in [4.1.2](#) may be used [see [Figure 21 c\)](#)].



a)