UDC 774.43 : 001.4

December 1992

Engineering drawing practice
Dimensioning
Concepts and general principles

DIN 406 Part 10

Technische Zeichnungen; Maßeintragung; Begriffe, allgemeine Grundlagen

This standard supersedes April 1977 edition of DIN 406 Part 1 and, together with December 1992 edition of DIN 406 Parts 11 and 12, supersedes August 1981 edition of DIN 406 Part 2.

See Explanatory notes for connection with International Standard ISO 129: 1985 published by the International Organization for Standardization (ISO).

Contents

1 Scope and field of application

This standard specifies concepts and general principles relating to dimensioning on engineering drawings. The specifications may be applied analogously to dimensioning on other technical documents.

Further details and practical examples are provided in other parts of the DIN 406 series of standards.

2 Concepts

In the definitions given below, an arrow (→) precedes terms which are themselves defined elsewhere in this clause.

2.1 Dimensioning from a common feature

Dimensioning from a common feature is a method in which a number of features are dimensioned from a common feature (i.e. where a number of dimensions of the same direction relate to a common origin).

The dimensions are based on the theoretically exact shape of the common feature.

2.2 Datum

A datum is a dimension of a feature which refers to another given feature of the same object (datum feature).

2.3 Single dimensioning

In single dimensioning, the features are individually dimensioned without reference to a common feature.

2.4 Finished dimension

A finished dimension is a → dimension which refers to the object as an end product.

NOTE: The representation of the object as an end product may refer to the raw (e.g. as formed), intermediate or finished state of the object, or even to a surface treatment.

2.5 Functional dimension

A functional dimension is a → dimension serving to define the shape, size or orientation of features, or the spaces between them, which are essential to the function of a part or group of parts.

2.6 Initial length

The initial length is the length of a part prior to its being bent.

2.7 Auxiliary dimension

An auxiliary dimension is a → dimension given for information purposes only and not essential to the geometrical definition of a part. It does not count as a dimensional specification for contractual purposes.

2.8 Leader line

A leader line used to indicate → dimensions is a line connecting the representation of an object and a dimensional value and is generally drawn as a line extending obliquely out of the representation.

2.9 Informative dimension

An informative dimension is a → dimension which is indicated in tender, sales and advertising documentation and in other technical documents. It is generally not specifically identified as such, is not toleranced and only counts as a dimensional specification for contractual purposes when this has been expressly agreed between the contracting parties.

NOTE: If, in a given document, informative dimensions need to be distinguished from other dimensions, they may be identified as such (e.g. by a lower-case i in a circle being placed next to them).

Continued on pages 2 to 6

2.10 Chain dimensioning

In chain dimensioning, single dimensions are indicated consecutively.

2.11 Dimensioning by coordinates

Dimensioning by coordinates is a form of → dimensioning from a common feature within a system of (cartesian or polar) coordinates.

2.12 Dimension

A dimension is a physical quantity defined by a numerical value and a unit of measurement. The dimensions in this standard are linear dimensions, which are indicated in units of length, and angular dimensions, indicated in units of angle.

2.13 Dimensioning by tables

In dimensioning by tables, the parts and/or features and/or dimensions are identified by digits or letters, which are entered in tables together with the corresponding → dimensional values.

2.14 Projection line

A projection line is a line drawn to connect the feature to be dimensioned to the associated → dimension line.

2.15 Dimension line

A dimension line is a straight or curved line running between two edges, between an edge and a → projection line, or between two → projection lines. Where drawings and/or dimensioning are simplified, the dimension line may terminate at only one of the features referred to.

2.16 Termination

A termination is a marker on a → dimension line that indicates where the line ends.

2.17 Centre line

A centre line is a line that defines the geometrical centre of features in drawings.

2.18 Parallel dimensioning

Parallel dimensioning is a form of → dimensioning from a common feature in which the features are individually dimensioned by way of dimension lines drawn parallel or concentric to each other.

2.19 Check dimension

A check dimension is a → dimension designated as requiring particular consideration when the scope or stringency of inspection is specified.

2.20 Raw dimension

A raw dimension is a → dimension which refers to the initial geometry of an object.

2.21 Line of symmetry

A line of symmetry identifies the plane of symmetry which divides an object notionally into two symmetrical halves.

2.22 Superimposed running dimensioning

Superimposed running dimensioning is a form of → dimensioning from a common feature in which each feature is dimensioned from a common origin with the dimensional values being given in ascending progression. The → dimension lines are generally placed as a superimposed series.

2.23 Repetition

For the purposes of this standard, 'repetition' is the regular recurrence of features at equal intervals or angles which are assigned to one or more common datum features (also termed 'repetetive features').

2.24 Theoretically exact dimension

A theoretically exact dimension is a → dimension used to indicate the geometrically ideal (theoretically exact) orientation or form of a dimensioned feature.

2.25 Pre-work dimension

A pre-work dimension is a → dimension which defines an intermediate state during the processing of a feature (e.g. the → dimension prior to grinding or coating).

2.26 Other concepts

For definitions of 'actual size', 'nominal size', 'tolerance' and 'fit', see ISO 286 Part 1.

For definitions of 'datum', 'datum feature' and 'datum system', see ISO 5459 and for the definition of origins, see ISO/DIS 10 209 Part 2.

For definitions relating to drawings, see DIN 199 Part 1, and for those associated with components, assembly units, etc., DIN 199 Part 2.

3 General principles

3.1 Dimensioning elements

The elements used in dimensioning are:

- dimension lines;
- projection lines;
- terminations;
- dimensional values;
- dimensional values with symbol for tolerance class;
- dimensional values with limits of size;
- units of measurement;
- markers as specified in subclause 3.2;
- leader lines.

Line widths shall be as specified in DIN 15 Parts 1 and 2.

3.2 Symbols

3.2.1 Arrowhead

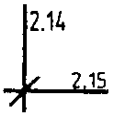
The arrowhead is a termination in the form of an isosceles triangle

- with an included angle of 15° and a length of ten times the width of the dimension line, or
- with an included angle of 90° and a length of four times the width of the dimension line.

Arrowheads are placed at the ends of the dimension or leader lines with their tips ending on the associated projection line or outline.

3.2.2 Oblique stroke

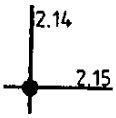
The oblique stroke is a termination running from bottom left to top right at an angle of 45° to the lay of the drawing, with a length of 12 times the width of the dimension line. The centre of the oblique stroke passes through the intersection of dimension line, projection line or feature outline [1].



1) The specifications '2.14' and '2.15' in this drawing and the following drawings are references to the corresponding subclauses in clause 2.

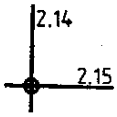
3.2.3 Dot

The dot is a dimension line termination which has a diameter 5 times the width of the wider of the lines to which it is assigned. The centre of the dot shall be placed on the intersection of dimension line and projection line or feature outline.

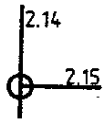


3.2.4 Circle

3.2.4.1 The dot used as a dimension line termination may also be drawn as a circle.

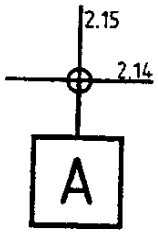


3.2.4.2 The circle used to indicate the origin is a dimension line termination which is 8 times the width of the wider of the two intersecting lines. The centre of the circle shall be placed on the intersection of dimension line and the line of the datum feature.



3.2.4.3 A circle from the bottom of which a tangent is drawn horizontally, ending in an arrowhead, is a graphical symbol that is used instead of the written indication 'initial length' and is always placed before the dimensional value of the initial length. This circle has a diameter equal to ten times the line width of the lettering. The length of the line with the arrowhead is equal to 1,5 times the diameter of the circle (arrowhead: leg angle of 15°, length ten times the line width of the lettering).

3.2.4.4 The circle used to indicate the origin signifies, when combined with a datum indication (cf. ISO 5459), that the specified datum is the origin of a dimensional system.



3.2.5 Triangle

3.2.5.1 The right-angled triangle is a graphical symbol which is used instead of the written indication 'slope'. The orientation of the triangle is determined by the shape of the part at the point where it slopes (cf. figure 88 in DIN 406 Part 11, December 1992 edition).

The triangle is always placed before the dimensional value of the slope and has a leg ratio of 1 : 2 (length: 16 times line width of lettering).

3.2.5.2 For the graphical symbol used to indicate the features 'cone' and 'taper' (height of triangle: 16 times line width of lettering; ratio of base to height: 1 : 2) (see figure 2 in ISO 3040).

3.2.5.3 See figure 17 in ISO 7083 for graphical symbols used to indicate datums.

3.2.6 Frames

3.2.6.1 A frame consisting of two parallel lines set a distance twice the height of the lettering apart and connected at each end by semicircles is used to identify check dimensions. The frame may, where necessary, be divided into fields by vertical lines.

3.2.6.2 See figure 19 in ISO 7083 for the frame to be used for theoretically exact dimensions.

3.2.6.3 See figures 22 and 23 in ISO 7083 for the frame to be used for geometrical tolerances.

3.2.7 Underlining

An underlining is a straight thin continuous line drawn beneath the dimensional value. Underlining is used to identify dimensional values which differ in scale from the scale applying to the other dimensions in a drawing. This symbol is not to be used in computer assisted drawings.

3.2.8 Round brackets [2]

Round brackets are used to indicate auxiliary dimensions or supplementary indications, e.g. supplementary indications near the title block.

( )

3.2.9 Square brackets [2]

Square brackets are used to indicate raw and pre-work dimensions in drawings of assembly parts. They are also used for dimensions on parts which must be preserved as finished dimensions for the next highest stage of manufacture (e.g. finished bush in welded assembly).

[ ]

3.2.10 Curly brackets

Curly brackets are used to enclose groups of related indications.

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3.2.11 Square [2]

A square is a graphical symbol which is used together with the dimensional value of the side length to indicate that the feature concerned is a square of that size.

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[1] The specifications '2.14' and '2.15' in this drawing and the following drawings are references to the corresponding subclauses in clause 2.

[2] See DIN 6776 Part 1 for size.

3.2.12 Circle with oblique stroke [2]

A circle with an oblique stroke is a graphical symbol used to indicate a diameter.

3.2.13 Letter R [2]

The dimensional values of radii are identified by a capital R being placed in front of them.

3.2.14 Letter S [2]

The dimensional values of spherical features are additionally identified by a capital S being placed in front of the diameter symbol or of the capital R.

3.2.15 Letters SW [2]

The dimensional values of widths across flats are identified by the capitals letters SW being placed in front of them.

3.2.16 Semi-circle/curve symbol

The dimensional values of curve lengths are identified by a semi-circle (diameter: 14 times line width of lettering) preceding the dimensional value.

Where the drawing is prepared manually, a modified curve symbol may be placed above the dimensional value of the curve length.

3.2.17 Symmetry symbol

A symmetry symbol consists of two parallel thin continuous lines which are placed at right angles to, and axially on, the ends of a line of symmetry, their minimum length being 5 mm.

3.2.18 Other symbols

Other symbols (e.g. those specified in DIN 1302 or DIN 5473) may also be used. Such symbols shall be executed in accordance with the standardized rules of lettering and drawing.

3.3 Dimensioning systems

The objects represented may be dimensioned and toleranced with reference to their function, their production, or to the criteria of inspection.

In a given drawing, more than one such system of dimensioning may be used concurrently.

3.3.1 Dimensioning for function

Dimensioning for function is characterized by the selection, indication and tolerancing of dimensions being undertaken exclusively on the basis of design criteria aimed at ensuring that the parts of a product will combine smoothly so as to permit the product to fulfil its intended function. The manufacturing and inspection conditions are not taken into account.

3.3.2 Dimensioning for production

Dimensioning for production is characterized by the dimensions directly required for production purposes being calculated from the functional dimensions, indicated in the drawing and toleranced as a function of the functional dimensions so as to meet manufacturing requirements.

Dimensioning for production is a function of the particular production method.

3.3.3 Dimensioning for inspection

Dimensioning for inspection is characterized by the dimensions and dimensional tolerances being indicated in the drawing to suit the requirements of the intended inspection.

Dimensioning for inspection purposes is a function of the particular inspection procedure.

3.4 Orientation of drawing and lettering

3.4.1 The orientation of the drawing shall correspond to the reading direction of the title block.

3.4.2 All dimensions, graphical symbols and written specifications shall preferably be so indicated that they can be read in the viewing direction of the drawing from below and from the right (main reading direction).

3.5 Application

3.5.1 Drawings shall generally contain dimensions which refer to the object as it is represented.

3.5.2 All dimensional specifications which are necessary for a clear and complete description of an object shall be indicated in the drawing.

The drawing may refer to the raw state, an intermediate state or to the finished state of an object and may also include an information on surface treatment.

Features of an object shall only be dimensioned once in a drawing or set of drawings. Dimensions which are specified in associated documents (e.g. standards, supplementary drawings), shall not be repreated; they may, where appropriate, be indicated as auxiliary dimensions.

3.5.3 Dimensions shall be indicated in that part of the representation in which the feature concerned is most clearly recognizable.

As a rule, linear dimensions are indicated without unit symbols. The unit symbol which is exclusively or predominantly used shall be specified in the title block [3]. Other unit symbols shall be specified in the title block in parentheses; they shall also be indicated following the dimensional values concerned.

3.5.4 In the case of dimensional values indicated in decimal notation, a comma shall be used as the decimal marker [4].

3.5.5 See DIN 406 Part 12 for the indication of tolerances.

3.5.6 Dimension lines shall normally be drawn without a break from termination to termination.

When all dimensions are indicated in the same direction of reading, non-horizontal dimension lines may be interrupted to insert the dimensional values.

If the arrowhead termination is placed outside the limits of the dimension line, the dimension line shall be extended so as to project to the required length beyond the arrowhead.

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[2] See DIN 6776 Part 1 for size.

[3] See DIN 6771 Part 1.

[4] See DIN V 820 Part 2.

In any given drawing, only one of the following combinations of terminations is permitted:

- 15° arrowhead, dot/circle, common origin circles, or
- 90° arrowhead, oblique stroke, origin (only for particular fields of engineering, e.g. in construction drawing practice).

Dimension lines of radii shall be aligned on the centre of the radius.

3.5.7 Dimension lines and non-related projection lines shall not cross.

Standards referred to

DIN 15 Part 1	Technical drawings; lines; basic principles
DIN 15 Part 2	Technical drawings; lines; general application
DIN 199 Part 1	Terminology associated with drawings and item lists; drawings
DIN 199 Part 2	Terminology associated with drawings and item lists; item lists
DIN 406 Part 12	Engineering drawing practice; dimensioning; tolerancing of linear and angular dimensions
DIN V 820 Part 2	Standards work; presentation of standards
DIN 1302	General mathematical symbols and concepts
DIN 5473	Symbols and concepts in set theory; sets, relations and functions
DIN 6771 Part 1	Title blocks for drawings, plans and lists
DIN 6776 Part 1	Technical drawings; lettering; characters
ISO 286-1 : 1988	ISO system of limits and fits; bases of tolerances, deviations and fits
ISO 3040 : 1990	Technical drawings; dimensioning and tolerancing; cones
ISO 5459 : 1981	Technical drawings; geometrical tolerances; datums and datumsystems for geometrical tolerancing
ISO 7083 : 1983	Technical drawings; symbols for geometrical tolerancing: proportions and dimensions
ISO/DSI 10 209-2	Technical product documentation; concepts; concepts for projection methods

Other relevant standards

DIN 30	Drawings; simplified representations
DIN 406 Part 4	Engineering drawing practice; dimensioning; dimensioning for machine programming
DIN 4895 Part 1	Orthogonal coordinate systems; general concepts
DIN 6771 Part 6	Preprinted forms for technical documentation; drawings
DIN 6774 Part 1	Technical drawings; rules of execution; drawings suitable for reproduction
DIN 6774 Part 10	Technical drawings; rules of execution; computer-assisted drawings
ISO 1101 : 1983	Technical drawings; geometrical tolerancing; tolerancing of form, orientation, location and run-out; generalities, definitions, symbols, indications on drawings
ISO 1302 : 1978	Technical drawings; method of indicating surface texture on drawings
ISO 5455 : 1979	Technical drawings; scales
ISO/DIS 10 135-1	Technical drawings; indications for moulded parts; preforms

Previous editions

DIN 406 Part 1 to Part 3: 12.22; DIN 406 Part 4: 12.22, 05.37; DIN 406 Part 5: 11.24, 10.41; DIN 406 Part 6: 12.24, 01.26, 10.41; DIN 406: 09.49, 09.55; DIN 406 Part 3: 07.75; DIN 406 Part 2: 06.68, 04.80, 08.81; DIN V 406 Part 1: 10.70; DIN 406 Part 1: 04.77.

Amendments

The following amendments have been made to DIN 406 Part 1, April 1977 edition and DIN 406 Part 2, August 1981 edition:

a) the organization of the content of the standard has been revised;

b) concepts, features and systems of dimensioning have been specified;

c) the definition of 'auxiliary dimension' has been revised (cf. Explanatory notes).

Explanatory notes

On the publication of ISO 129 : 1985, Technical drawings; dimensioning; general principles, definitions, methods of execution and special indications', the responsible committee of the *Normenausschuß Zeichnungswesen* (Drawing Practice Standards Committee) had to decide, on the basis of a draft translation, in what form the rules specified in that standard were to be incorporated in German standards.

Owing to the large number of text passages and figures needing supplementary elucidation (clarification or qualification) it was decided to revise DIN 406 Parts 1 to 3 on the basis of ISO 129 in such a way that the revised versions may serve as proposals for the next revision of ISO 129. In this respect, attention was also to be given to data (graphical and non-graphical) transfer in numerically controlled systems (CAx).

On the assumption that the standards of the DIN 406 series should give specifications of general validity, i.e. there should be no distinction made in the standards between manual and machine drawing, the whole subject of the 'indication of dimensions and tolerances in engineering drawings' will in future be organized as follows:

DIN 406 Part 10 Engineering drawing practice; dimensioning; concepts and general principles

DIN 406 Part 11 Engineering drawing practice; dimensioning; principles of application

DIN 406 Part 12 Engineering drawing practice; dimensioning; indication of tolerances for linear and angular dimensions

Greater clarity has been reached with respect to 'auxiliary dimensions' by omitting the term 'auxiliary dimensions for construction/production' previously included in the April 1977 edition of the standard. Auxiliary dimensions are, irrespective of their purpose in the drawing, of no significance for the geometrical shape of a part or configuration and are accordingly not toleranced. They serve only to provide (supplementary) information and do not apply to the manufacture or inspection of the parts.

English-German index of terms defined in this standard

Auxiliary dimension	Hilfsmaß, Infomationsmaß
Centre line	Mittellinie
Chain dimensioning	Kettenbemaßung
Check dimension	Prüfmaß
Datum	Bezugsmaß
Dimension	Maß
Dimension line	Maßlinie
Dimensioning by coordinates	Koordinatenbemaßung
Dimensioning by tables	Maßeintragung mit Hilfe von Tabellen
Dimensioning from a common feature	Bezugsbemaßung
Finished dimension	Fertigmaß
Functional dimension	Funktionsmaß
Initial length	gestreckte Länge
Leader line	Hinweislinie
Line of symmetry	Symmetrielinie
Parallel dimensioning	Parallelbemaßung
Pre-work dimension	Vorarbeitungsmaß
Projection line	Maßhilfslinie
Raw dimension	Rohmaß
Repetition	Teilung
Single dimensioning	Einzelbemaßung
Superimposed running dimensions	steigende Bemaßung
Termination	Maßlinienbegrenzung
Theoretically exact dimension	theoretisch genaues Maß

International Patent Classification

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