UDC 744.43:621.713.1

December 1992

Engineering drawing practice
Dimensioning
Tolerancing of linear and angular dimensions (modified version of ISO 406:1987)

DIN 406 Part 12

Technische Zeichnungen; Maßeintragung; Eintragung von Toleranzen für Längen- und Winkelmaße (ISO 406 : 1987, modifiziert)

This standard, together with December 1992 editions of DIN 406 Parts 10 and 11, supersedes August 1981 edition of DIN 406 Part 2.

In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.

Dimensions in mm

This standard incorporates the text of International Standard ISO 406 : 1987 'Technical drawings; tolerancing of linear and angular dimensions', with modifications introduced by the German national standards committee (cf. Explanatory notes).

This standard comprises the specifications of ISO 406 : 1987 and supplementary specifications required to take account of advances in drawing techniques (e.g. computer-assisted design) and due for submission to ISO/TC 10 for inclusion in the next revision of ISO 129 and ISO 406.

These supplementary specifications are shown shaded. The numbering of the figures corresponds to that in ISO 406. New figures serving to illustrate the supplementary specifications have been placed at the appropriate points in the text, but they have been numbered so as to follow on from the numbers in ISO 406.

The DIN Standards corresponding to the ISO Standards referred to in clause 2 are as follows:

ISO Standard	DIN Standard
ISO 129	DIN 406 Parts 10 and 11
ISO 3098-1	DIN 6776 Part 1

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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by least 75 % of the member bodies casting a vote.

International Standard ISO 406 was prepared by Technical Committee ISO/TC 10, Technical drawings.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

Continued on pages 2 to 5

0 Introduction

For the purposes of this International Standard, all dimensions and tolerances on the drawings have been stencilled in upright lettering. It should be understood that these indications could just as well be written in free-hand or inclined (italic) lettering without altering the meaning of the indications. For the presentation of lettering (proportions and dimensions), see ISO 3098-1.

1 Scope and field of application

This International Standards specifies the indication of tolerances for linear and angular dimensions on technical drawings. Indicating such tolerances does not nece. ily imply the use of any particular method of production, measurement or gauging.

2 References

The following standards contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 129 : 1985 Technical drawings; dimensioning, general principles, definitions, methods of execution and special indications

ISO 3098-1 : 1974 Technical drawings; lettering; currently used characters.

For further references to standards, see the 'Standards referred to' section.

3 Units

Deviations shall be expressed in the same unit as the nominal size.

If two deviations relating to the same dimension have to be shown, both shall be expressed to the same number of decimal places (see figure 2), except if one of the deviations is zero (see figure 5).

If, exceptionally, units are to apply to individual dimensions (e.g. m for metres) which do not apply to the other dimensions, then the unit concerned shall be stated both in the nominal dimension and in the indication of the tolerance (see figure 18).

$\frac{6m+0,01m}{}$

Figure 18

4 Indication of the components of a linear dimension

The characters used for indicating tolerance symbols and limit deviations shall preferably be of the same height as those used for the nominal sizes. They may be one size smaller than the characters for the nominal sizes, but their minimum height shall be 2,5 mm.

The components of a given dimension may be indicated

a) by general tolerances (cf. 'Other relevant standards' section);

b) by symbols denoting the tolerance class (cf. subclause 4.1);

c) by limit deviations (cf. subclause 4.2);

d) by geometrical tolerances (cf. 'Other relevant standards' section);

e) by means of statistical tolerancing (cf. DIN 7186 Part 1).

All tolerances apply to the finished state, including any surface finish, unless otherwise specified (cf. DIN 50 960 Part 2).

This principle does not apply in the case of coatings of paint or varnish which serve as protective or identification colours.

4.1 Tolerance classes as specified in ISO 286-1

The components of a toleranced dimension shall be indicated in the following order:

a) the nominal size;

b) the tolerance symbol.

If, in addition to the symbols (see figure 1), it is necessary to express the values of the deviations (see figure 2) or the limits of size (see figure 3), the additional information shall be shown in parentheses.

The tolerance symbol may also be tabulated in the drawing together with the relevant limit deviations (see figure 19); presentation in tabular form is recommended in drawings where a number of different tolerances are to be specified.

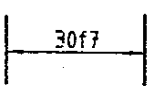

Figure 1

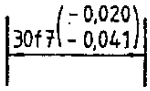

Figure 2

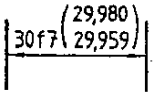

Figure 3

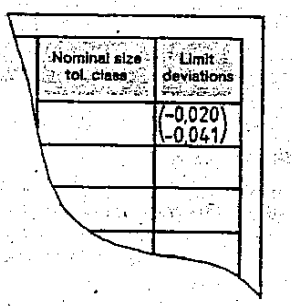

Figure 19

4.2 Limit deviations

The components of a toleranced dimension shall be indicated in the following order (see figures 4 to 6):

a) the nominal size;

b) the values of the deviations.

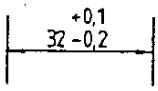

Figure 4

If one of the two deviations is zero, this may be expressed by the digit zero (see figure 5).

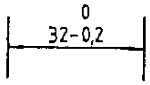

Figure 5

If the tolerance is symmetrical in relation to the nominal size, the value of the deviations shall be indicated once only, preceded by the sign ± (see figure 6).

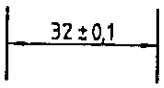

Figure 6

Nominal size and limit deviations may be indicated in the same line, the upper and lower deviation then being separated by an oblique stroke (see figures 20 and 21).

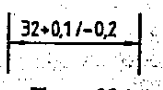

Figure 20

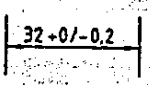

Figure 21

4.3 Limits of size

The limits of size may be indicated by an upper and lower dimension (see figure 7).

NOTE. Indicating limits of size by upper and lower dimensions shall be subject to agreement between the parties respectively preparing and using the drawing.

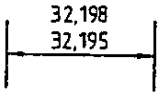

Figure 7

4.4 Limits of size in one direction

If a dimension needs to be limited in one direction only, this may be indicated by adding 'min.' or 'max.' to the dimension (see figure 8).

Such indications are to be avoided in production drawings, but are particularly suitable for drawings prepared for tenders or for approval purposes.

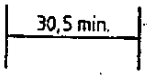

Figure 8

5 Order of indication of deviations and limits of size

The upper deviation or the upper limit of size shall be written in the upper position and the lower deviation or the lower limit of size in the lower position, irrespective of whether a hole or a shaft is toleranced.

6 Indication of tolerances on drawings of assembled parts

6.1 Symbols of tolerance class

The tolerance symbol for the hole shall be placed before that for the shaft (see figure 9) or above it (see figure 10), the symbols being preceded by the nominal size indicated once only.

See subclause 4.2, figures 20 and 21.

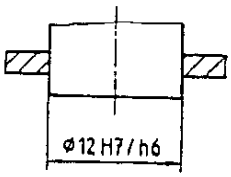

Figure 9

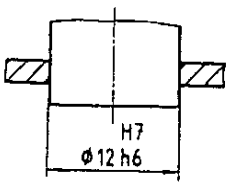

Figure 10

If it is also necessary to specify the values of the deviations, they should be written in parentheses (see figure 11) or in a table (see figure 19).

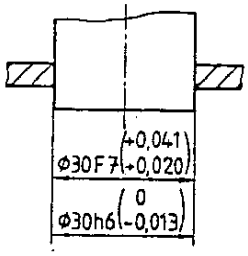

Figure 11

For the sake of simplicity (notwithstanding ISO 129), dimensioning with only one dimension line may be used (see figure 22).

6.2 Limit deviations

The dimension for each of the components of the assembled parts shall be preceded by the name (see figure 12) or item reference[1]) (see figure 13), the dimension for the hole being placed in both cases above that for the shaft.

Use of the method shown in figure 12 is not recommended.

Indications shall be arranged as shown in figure 22 instead of the arrangement shown in figure 13.

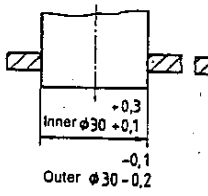

Figure 12

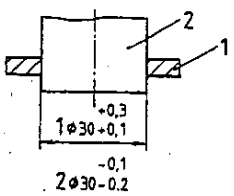

Figure 13

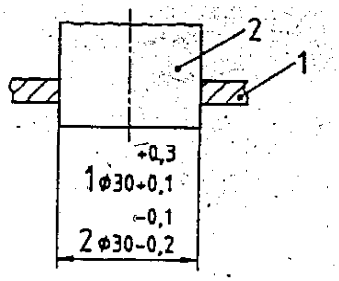

Figure 22

[1]) National footnote: Cf. ISO 6433.

7 Indication of the components of an angular dimension

The rules given for the indication of tolerances on linear dimensions are equally applicable to angular dimensions (see figures 14 and 15), except that the units of the basic angle and the fractions thereof, as well as the deviations, shall always be indicated (see figures 14 to 17). If the basic angular dimension or the angular deviation is expressed in either minutes of a degree or seconds of a minute of a degree, the value of the minute or second shall be preceded by 0° or 0° 0', as applicable.

The zeros preceding the value may be omitted (see figure 23).

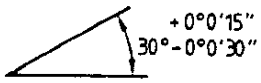

Figure 14

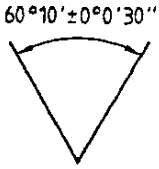

Figure 15

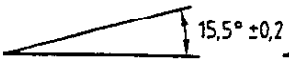

Figure 16

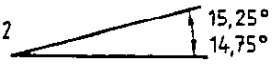

Figure 17

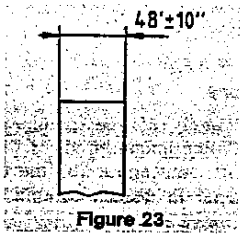

Figure 23

8 Limiting specifications

If a tolerance is only to apply for a limited area, it may be indicated as shown in figures 24 and 25.

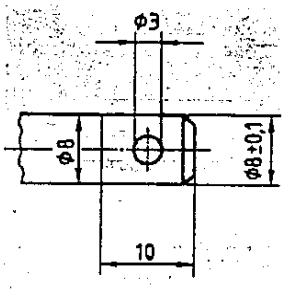

Figure 24

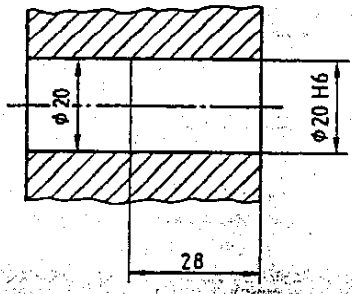

Figure 25

9 Spacings

Spacings between square holes, slits, keyways, etc. are generally to be dimensioned from edge to edge, i.e. from inside edge to inside edge (see figures 26 and 27).

It is to be noted that the results of tolerances differ depending on the way in which they are indicated. When dimensions are indicated consecutively from space to space (chain dimensioning), the tolerances of the single dimensions accumulate. This can be avoided by dimensioning from a common feature (see figure 26).

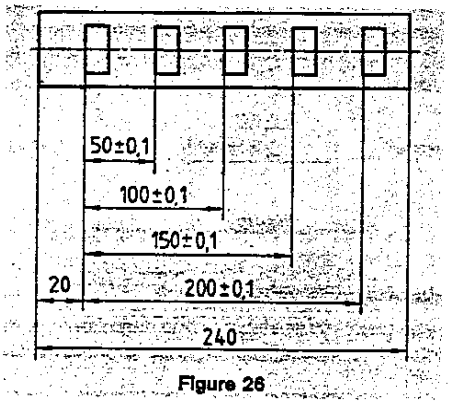

Figure 26

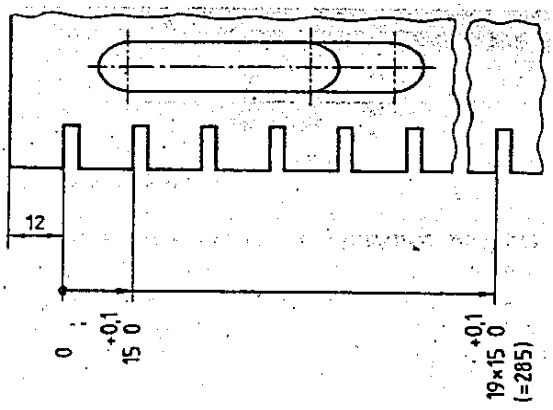

Figure 27

Standards referred to

See clause 2 for standards referred to in ISO 406.

DIN 406 Part 10	Engineering drawing practice; dimensioning; concepts and general principles
DIN 406 Part 11	Engineering drawing practice; dimensioning; principles of application
DIN 6776 Part 1	Technical drawings; lettering; characters
DIN 7186 Part 1	Statistical tolerancing; concepts, application and indications on drawings
DIN 50 960 Part 1	Electroplated and chemically applied coatings; indications on drawings
ISO 129 : 1985	Technical drawings; dimensioning; general, definitions, methods of execution and special indications
ISO 286-1 : 1988	ISO system of limits and fits; bases of tolerances, deviations and fits
ISO 406 : 1987	Technical drawings; tolerancing of linear and angular dimensions
ISO 3098-1 : 1974	Technical drawings; lettering; currently used characters
ISO 6433 : 1981	Technical drawings; item references

Other relevant standards

DIN 199 Part 1	Terminology associated with drawings and parts lists; drawings
DIN 7182 Part 1	Sizes, deviations, tolerances and fits; basic concepts
ISO 1101 : 1983	Technical drawings; geometrical tolerancing; tolerancing of form, orientation, location and run-out; generalities, definitions, symbols, indications on drawings
ISO 1660 : 1987	Technical drawings; dimensioning and tolerancing of profiles
ISO 2768-1 : 1989	Tolerances for linear and angular dimensions without individual tolerance indications
ISO 3040 : 1990	Technical drawings; dimensioning and tolerancing; cones
ISO 5458 : 1987	Technical drawings; geometrical tolerancing; positional tolerancing
ISO 5459 : 1981	Technical drawings; geometrical tolerancing; datums and datum systems for geometrical tolerances
ISO 8015 : 1985	Technical drawings; fundamental tolerancing principle

Previous editions

DIN 406 Parts 1 to 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 2: 06.68, 04.80, 08.81.

Amendments

The following amendments have been made to the August 1981 edition of DIN 406 Part 2.

a) A modified version of ISO 406 has been incorporated.

b) It has been specified that deviations are to be written in figures of the same size as those used for the nominal sizes.

c) Parts of clauses 16 and 17 of DIN 406 Part 2, August 1981 edition have been included.

d) The presentation of the standard has been reorganized.

Explanatory notes

International Standard ISO 406 was prepared by ISO/TC 10/SC 5, with significant input from the German experts participating. Following the publication of draft DIN ISO 406 in December 1986, the national standpoint on future developments was discussed, with the result that it was decided to include in this standard relevant specifications previously made in DIN 406 Part 2.

International Patent Classification

G 01 B