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General tolerances for linear and angular dimensions and geometrical tolerances

(not to be used for new designs)

DIN 7168

Allgemeintoleranzen; Längen- und Winkelmaße, Form und Lage (nicht für Neukonstruktionen)

Supersedes May 1981 edition of DIN 7168 Part 1 and July 1986 edition of DIN 7168 Part 2.

This standard is not to be used for new designs. General tolerances for these are now covered by ISO 2768 Parts 1 and 2. See also clause 1 and the Explanatory notes.

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.

1 Scope

This standard is intended to ensure that all drawings prepared to date in which general tolerances have been specified on the basis of DIN 7168 will remain intelligible and be interpreted correctly, and also to inform the user of this standard that, for all new designs, tolerances are to be specified on the basis of ISO 2768 Parts 1 and 2.

2 Field of application

General tolerances as specified in this standard are applicable for the dimensions of parts produced by metal removal (i.e. chip removal)[1], unless this involves special manufacturing processes for which other standards specifying general tolerances apply.

General tolerances as specified here shall apply when reference is made to this standard in drawings or associated documents (e.g. delivery conditions) in accordance with clause 5.

If special general tolerances are specified in accordance with other standards (cf. page 6), the standards concerned shall be indicated on the drawing or in the associated documents. If, in cases where production specifications contain references to more than one standard on general tolerances, there is any doubt as to which standard is to apply for a given linear or angular dimension, then the standard specifying the larger tolerance shall be deemed to apply.

Accordingly, a dimension between an unfinished and a finished surface on a blank (e.g. on a casting blank or forging blank), for which no individual tolerance has been indicated, will be required to meet the general tolerance given in the relevant standard on blanks, provided that is indeed the larger tolerance. However, for a dimension between two finished surfaces, the general tolerance specified in DIN 7168 shall always apply.

Production specifications in which linear or angular dimensions (but not auxiliary dimensions) appear without individually indicated tolerances shall be considered incomplete if there is no reference, or inadequate reference, to general tolerances.

General tolerances as specified in this standard apply for:

a) linear dimensions, such as external sizes, internal sizes, step sizes, diameters, clearances (cf. table 1), external radii and chamfer heights for broken edges (cf. table 2);
b) angular dimensions (cf. table 3), both those indicated and those not usually indicated on drawings, such as 90° angles or the angles of regular polygons;
c) linear and angular dimensions produced by machining assembled parts;
d) workpiece features for which no individual tolerances of form and position are indicated.

General tolerances as specified in this standard do not apply for:

a) linear and angular dimensions and workpiece features for which tolerances have been individually indicated;
b) linear and angular dimensions and workpiece features for which other standards on general tolerances are specified in drawings or associated documents;
c) auxiliary dimensions enclosed in brackets (cf. DIN 406 Part 2);
d) theoretically exact dimensions enclosed in rectangular frames as specified in ISO 1101;
e) angular dimensions on circular graduations;
f) 90° angles, not indicated on the drawing, between lines forming coordinate axes;
g) linear and angular dimensions produced by the assembly of parts;
h) workpiece features which are not produced by removal of material, in accordance with the indication of a semi-finished product on drawings.

[1]) For concepts relating to manufacturing processes, see DIN 8580.

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3 General tolerances for linear and angular dimensions

3.1 Linear dimensions

Table 1. **Permissible deviations for linear dimensions, except for external radii and chamfer heights**

Tolerance class	Permissible deviations, in mm, for nominal sizes, in mm,											
	from 0,5[1]) to 3	over 3 up to 6	over 6 up to 30	over 30 up to 120	over 120 up to 400	over 400 up to 1000	over 1000 up to 2000	over 2000 up to 4000	over 4000 up to 8000	over 8000 up to 12000	over 12000 up to 16000	over 16000 up to 20000
f (fine)	± 0,05	± 0,05	± 0,1	± 0,15	± 0,2	± 0,3	± 0,5	± 0,8	-	-	-	
m (medium)	± 0,1	± 0,1	± 0,2	± 0,3	± 0,5	± 0,8	± 1,2	± 2	± 3	± 4	± 5	± 6
g (coarse)	± 0,15	± 0,2	± 0,5	± 0,8	± 1,2	± 2	± 3	± 4	± 5	± 6	± 7	± 8
sg (very coarse)	-	± 0,5	± 1	± 1,5	± 2	± 3	± 4	± 6	± 8	± 10	± 12	± 12

[1]) For nominal sizes below 0,5 mm, the deviations shall be indicated adjacent to the relevant nominal size.

Table 2. **Permissible deviations for external radii, r (cf. figure 1 for example), and chamfer heights, h (cf. figure 2 for example)**

Tolerance class	Permissible deviations, in mm, for nominal sizes, in mm,				
	from 0,5[1]) to 3	over 3 up to 6	over 6 up to 30	over 30 up to 120	over 120 up to 400
f (fine)	± 0,2	± 0,5	± 1	± 2	± 4
m (medium)					
g (coarse)	± 0,2	± 1	± 2	± 4	± 8
sg (very coarse)					

[1]) For nominal sizes below 0,5 mm, the deviations shall be indicated adjacent to the relevant nominal size.

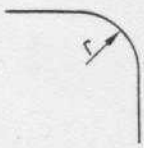


Figure 1.

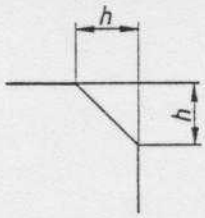


Figure 2.

3.2 Angular dimensions

General tolerances for angular dimensions apply irrespective of the actual dimensions of the lengths, i.e. the angular deviations may occur both on workpieces with maximum-material sizes and on workpieces with minimum-material sizes. The upper and lower deviations do not limit the form deviations of the legs or surfaces forming the angle.

Note. In the case of workpieces exhibiting deviations of form, the angle is defined by the direction of the straight lines or planes applied to the two angle legs under the minimum material conditions (cf. ISO 1101 for the definition of the minimum condition).

Table 3. **Permissible deviations for angular dimensions**

Tolerance class	Permissible deviations, in units of angle, for nominal sizes of the shorter leg, in mm,				
	over 10	over 10 up to 50	over 50 up to 120	over 120 up to 400	over 400
f (fine)	± 1°	± 30′	± 20′	± 10′	± 5′
m (medium)					
g (coarse)	± 1° 30′	± 50′	± 25′	± 15′	± 10′
sg (very coarse)	± 3°	± 2°	± 1°	± 30′	± 20′

4 General geometrical tolerances

4.1 Tolerancing principle as specified in ISO 8015

General tolerances based on the tolerancing principle specified in ISO 8015 are only to be applied when the drawing concerned contains the reference 'Tolerancing to ISO 8015'. Where that is the case, the general geometrical tolerances (i.e. the tolerances of form and position) apply independently of the actual local sizes of the workpiece feature. Each individual tolerance requirement must be met. The general geometrical tolerances may thus also be applied even if the features are everywhere at their maximum material size. For fits, the envelope requirement must also be specified, and this shall be individually indicated on the drawings (cf. Explanatory notes).

4.1.1 General tolerances of form

4.1.1.1 Straightness and flatness

The general tolerances on straightness and flatness shall be as specified in table 4. Tolerances on straightness shall be selected from the table on the basis of the length of the corresponding line, while, for flatness tolerances, selection shall be based on the longer lateral length of the surface, or on the diameter of the circular surface.

4.1.1.2 Circularity

The general tolerance on circularity shall be equal to the numerical value of the diameter tolerance, but in no case shall it be greater than the respective tolerance on radial run-out given in table 6 (cf. Explanatory notes).

Table 4. **General tolerances on straightness and flatness**

Tolerance class	General tolerances on straightness and flatness, in mm, for a nominal size, in mm, of								
	up to 6	over 6 up to 30	over 30 up to 120	over 120 up to 400	over 400 up to 1000	over 1000 up to 2000	over 2000 up to 4000	over 4000 up to 8000	over 8000
R	0,004	0,01	0,02	0,04	0,07	0,1	–	–	–
S	0,008	0,02	0,04	0,08	0,15	0,2	0,3	0,4	–
T	0,025	0,06	0,12	0,25	0,4	0,6	0,9	1,2	1,8
U	0,1	0,25	0,5	1	1,5	2,5	3,5	5	7

4.1.1.3 Cylindricity

General tolerances on cylindricity have not been specified.

Note. If the envelope requirement is to apply to fits with cylindrical surfaces, the dimension concerned shall be identified by the symbol Ⓔ, (e.g. ∅ 25 Ⓔ or ∅ 25 H 7 Ⓔ).

4.1.2 General tolerances of position

4.1.2.1 Parallelism

The limitation of the deviation in parallelism is given either by the general tolerances on straightness or flatness (cf. subclause 4.1.1.1), or by the tolerance on the distance between the parallel lines or surfaces, whichever is the greater.

The longer of the two features shall be taken as the datum. If both features are of the same nominal size, then either may serve as the datum. If, for functional reasons, these datum specifications are not permissible, then the tolerance on parallelism shall be individually indicated as specified in ISO 1101.

Note. If the envelope requirement is to apply to fits with flat mating surfaces, then the dimension concerned shall be identified by the symbol Ⓔ, as specified in ISO 8015 (e.g. 30 Ⓔ, or 30 h 7 Ⓔ).

4.1.2.2 Perpendicularity and inclination

General tolerances on perpendicularity and inclination have not been specified. Instead, the general tolerances on angular dimensions may be applied (cf. subclause 3.2).

4.1.2.3 Symmetry

The general tolerances for symmetrical, but not axially symmetrical, features are to be taken from table 5. These general tolerances also apply in cases where one of the symmetrical features is axially symmetrical and the other is not.

For general tolerances on symmetry, the longer feature shall be taken as the datum. That applies to all features which may be referred to each other. If both features are of the same nominal length, then either may serve as the datum. If, for functional reasons, these datum specifications are not permissible, the tolerance on symmetry shall be individually indicated as specified in ISO 1101.

4.1.2.4 Coaxiality

General tolerances on coaxiality have not been specified. The deviation in coaxiality may in extreme cases be as great as the tolerance value for radial run-out given in table 6, since the deviation in radial run-out comprises the deviation in coaxiality and the deviation in circularity (cf. Explanatory notes).

Table 5. **General tolerances on symmetry**

Tolerance class	Symmetry tolerance, in mm
R	0,3
S	0,5
T	1
U	2

4.1.2.5 Radial run-out

The general tolerances on radial run-out shall be as specified in table 6. For general tolerances on radial run-out, the bearing surfaces shall be taken as the datum, if they are designated as such. Otherwise, the longer of the two features shall be taken as the datum. If both features are of the same nominal size, either may serve as the datum. If, for functional reasons, these datum specifications are not permissible, the tolerance on radial run-out shall be individually indicated as specified in ISO 1101.

4.1.2.6 Axial run-out

The general tolerances on axial run-out shall be as specified in table 6.

For general tolerances on axial run-out, the bearing surfaces shall be taken as the datum, if they are designated as such. Otherwise, each of the axially symmetric features may serve as the datum.

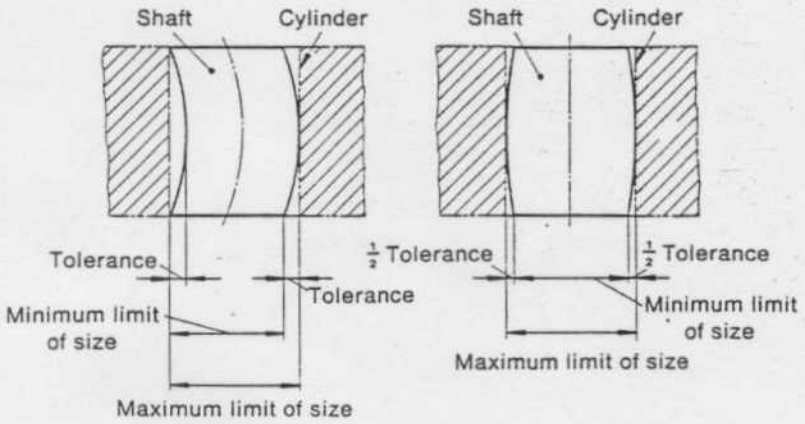
Table 6. **General tolerances on radial and axial run-out**

Tolerance class	Radial and axial run-out tolerances, in mm
R	0,1
S	0,2
T	0,5
U	1

4.2 Tolerancing principle 'envelope requirement without indication on drawing' as specified in DIN 7167

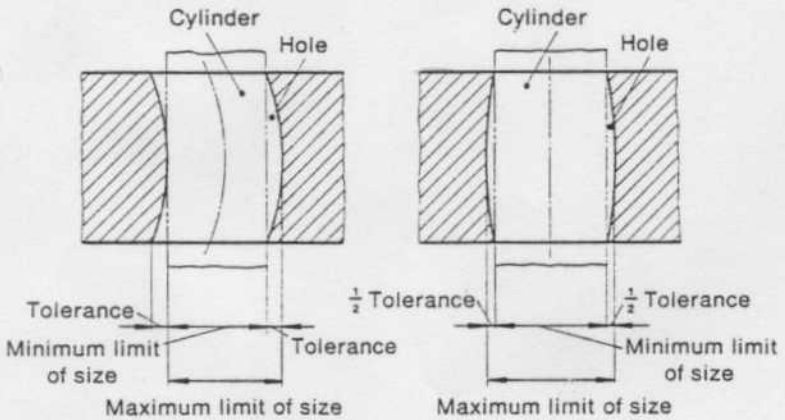
4.2.1 General tolerances of form

General tolerances of form have not been specified. All deviations in form shall, if no individual tolerances of form have been indicated, be limited by the dimensional tolerances as follows.



In the case of shafts, the surface of the feature shall not exceed the geometrically ideal form (cylinder) at its maximum material size (envelope requirement), nor shall the actual dimension be smaller than the least material limit at any point.

Note. The cylinder at its maximum material limit is embodied by the GO ring gauge.



In the case of holes, the surface of the feature shall not be smaller than the geometrically ideal form (cylinder) at its minimum material size (envelope requirement), nor shall the actual dimension be greater than the maximum material size at any point.

Note. The cylinder at its minimum material limit of size is embodied by the GO plug gauge.

4.2.2 General tolerances of position

4.2.2.1 Parallelism

For tolerances on parallelism, the specifications given in subclause 4.2.1 shall apply analogously.

4.2.2.2 Perpendicularity and inclination

General tolerances on perpendicularity and inclination have not been specified. Instead, the general tolerances for angular dimensions may be applied (cf. subclause 3.2).

Note. Previously, the rule was that the deviations in perpendicularity should lie within the dimensional tolerances, measured in a rectangular system of coordinates. In practice, however, this limitation was and is hardly ever observed in industry because it is seldom required for functional reasons.

4.2.2.3 Symmetry

For tolerances on symmetry of non-axially symmetrical workpiece features, the values specified in table 7 shall apply. These tolerances on symmetry shall also apply to relationships between workpiece features where one of the features is axially symmetrical and the other is not.

Table 7. **General tolerances on symmetry for non-axially symmetrical workpiece features**

Tolerance class	Tolerance on symmetry, in mm
02[1])	0,06
01[1])	0,15
A	0,3
B	0,5
C	1
D	2

[1]) Mainly applies for precision engineering applications.

The above symmetry tolerances may also obtain in the case of workpieces at their 'maximum material size'.

4.2.2.4 Radial and axial run-out

For tolerances on radial run-out in the relationship of two or more axially symmetrical workpiece features, and for tolerances on axial run-out, the values specified in table 8 shall apply.

Table 8. **General tolerances on radial run-out in the relationship between axially symmetrical features, and general tolerances on axial run-out**

Tolerance class	Tolerance on radial and axial run-out, in mm
02[1])	0,02
01[1])	0,05
A	0,1
B	0,2
C	0,5
D	1
[1]) Mainly applies for precision engineering applications.	

The above tolerances on radial run-out may also obtain in the case of workpieces at their 'maximum material size', but this does not apply to axial run-out tolerances, because axial run-out must always lie within the linear tolerances.

5 Designation and indication on drawings of general tolerances as specified in DIN 7168

5.1 Designation of general tolerances for dimensions, only

Example:

DIN 7168 — m

DIN number

Tolerance class m as per clause 3 of this standard

5.2 Designation of general tolerances based on ISO 8015

Example:

DIN 7168 — m — S

DIN number

Tolerance class m as per clause 3 for size tolerance

Tolerance class S as per subclause 4.1 for tolerances of form **and** position

5.3 Designation of general tolerances based on principle of 'envelope requirement without indication on drawing' as per DIN 7167

Example:

DIN 7168 — m — C

DIN number

Tolerance class m as per clause 3 for size tolerance

Tolerance class C as per subclause 4.2 for tolerance of position

Standards referred to

DIN 406 Part 2	Indication of dimensions on drawings
DIN 7167	Relationship between dimensional and geometrical tolerancing; envelope requirement without individual tolerance indications
DIN 8580	(at present at the stage of draft) Manufacturing processes; concepts and classification
ISO 1101:1983	Technical drawings; geometrical tolerancing; tolerancing of form, orientation, location and run-out; generalities, definitions, symbols, indications on drawings
ISO 2768 Part 1:1989	Tolerances for linear and angular dimensions without individual tolerance indications
ISO 2768 Part 2:1989	Geometrical tolerances for features without individual tolerance indications
ISO 8015:1985	Technical drawings; fundamental tolerancing principle

Other relevant standards

DIN 1680 Part 1	Rough castings; general tolerances and machining allowances; general
DIN 1680 Part 2	Rough castings; general tolerances
DIN 1683 Part 1	Rough castings; general tolerances and machining allowances
DIN 1684 Part 1	Rough castings of malleable iron; general tolerances and machining allowances
DIN 1685 Part 1	Rough castings of grey iron with nodular graphite; general tolerances and machining allowances
DIN 1686 Part 1	Rough castings of grey iron with flake graphite; general tolerances and machining allowances
DIN 1687 Part 1	Heavy metal alloy rough castings; sand castings; general tolerances and machining allowances
DIN 1687 Part 3	Heavy metal alloy rough castings; chilled mould castings; general tolerances and machining allowances
DIN 1687 Part 4	Heavy metal alloy rough castings; diecastings; general tolerances and machining allowances
DIN 1688 Part 1	Light metal alloy rough castings; sand castings; general tolerances and machining allowances
DIN 1688 Part 3	Light metal alloy rough castings; chilled mould castings; general tolerances and machining allowances
DIN 1688 Part 4	Light metal alloy rough castings; dicastings; general tolerances and machining allowances
DIN 6129	Packaging materials; glass bottles and hollow bodies; permissible deviations for dimensions without tolerance indication in the case of bottles manufactured fully automatically
DIN 6930 Part 2	Stamped steel parts; cut parts from flat products; dimensions and permissible deviations
DIN 7526	Steel forgings; tolerances and permissible deviations for drop forgings
DIN 8570 Part 1	General tolerances for welded structures; linear and angular dimensions
DIN 8570 Part 3	General tolerances for welded structures; geometrical tolerances
DIN 28 005 Part 1	General tolerances for vessels; general purpose vessels
DIN 58 165	Permissible deviations for optical components; dimensions without individual tolerance indication; material and machining defects

Previous editions

DIN 7168: 02.56, 04.60, 03.66; DIN 7168 Part 1: 08.70, 08.77, 10.79, 05.81; DIN 7168 Part 2: 01.74, 10.79, 05.81, 07.86.

Amendments

The May 1981 edition of DIN 7168 Part 1 and the July 1986 edition of DIN 7168 Part 2 have been combined in one standard, the scope of which has been designated as not being applicable for new designs (see Explanatory notes).

Explanatory notes

When this standard was being revised prior to publication of the August 1977 edition, the aim was already to arrange the content of the two Parts of the standard so that they would complement each other as much as possible. Initially, the introduction in Part 2 of a table giving tolerances on perpendicularity and inclination was planned, supplementary to table 3 in DIN 7168 Part 1. After thorough examination, however, this idea was abandoned. The reasons for this are given in the Explanatory notes to DIN 7168 Part 2 (May 1981 edition).

In the past, misunderstandings and difficulties were frequently experienced in connection with the values in mm per 100 mm then still specified in table 3. For this reason, the corresponding column in the table has been omitted, and permissible deviations are now given in units of angle, only. For cases where metrological reasons require angular dimensions to be converted into linear dimensions, the tangent values for the individual angles have been listed in table 9 below.

The present standard should not be used for new designs, these now being covered by ISO 2768 Parts 1 and 2. The ISO Standards are largely based on the specifications of the former DIN Standards. For further details, please consult the national forewords to the German editions of ISO 2768 Parts 1 and 2.

The Explanatory notes in the earlier editions of DIN 7168 Parts 1 and 2 explained in detail the concepts behind the tolerancing specifications. These explanations have not been included in this edition. However, as this edition is, in terms of its content, an otherwise unaltered combination of the earlier standards, the explanations concerned remain relevant for the specifications made here.

Table 9. **Angles and their tangent values**

Angle	Tangent	Angle	Tangent
10′	0,0029	30′	0,0087
15′	0,0044	50′	0,0145
20′	0,0058	1°	0,0175
25′	0,0073	1° 30′	0,0262

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