TOLERANCES FOR FORM AND POSITION

General notes on tolerances for form and position

A tolerance for a **form and position** of an element (area, axis, point or centre axis) defines the zone within which every point of this element has to lie. Depending on the quality to be toleranced and its typical dimensions the **tolerance zone** falls within one of the following

· the area within a circle
· the area between two concentric circles
· the area between two parallel straight lines
· the area between two equidistant lines
· the space between two parallel planes
· the space between two equidistant planes
· the space between a cylinder
· the space between two coaxial cylinders
· the space within a square

GENERAL TOLERANCES [mm] for tools produced in clamped position (DIN ISO 2768)

Tolerance class H

Range:	...10	> 10 ...30	> 30 ...100	> 100 ...300	> 300 ...1000	> 1000 ...3000
▱ —	0,02	0,05	0,1	0,2	0,3	0,4
⊥	0,2	0,2	0,2	0,3	0,4	0,5
=	0,5	0,5	0,5	0,5	0,5	0,5
/	0,1	0,1	0,1	0,1	0,1	0,1

Tolerance class K

Range:	...10	> 10 ...30	> 30 ...100	> 100 ...300	> 300 ...1000	> 1000 ...3000
▱ —	0,05	0,1	0,2	0,4	0,6	0,8
⊥	0,4	0,4	0,4	0,6	0,8	1
=	0,6	0,6	0,6	0,6	0,8	1
/	0,2	0,2	0,2	0,2	0,2	0,2

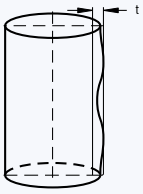
Tolerance class L

Range:	...10	> 10 ...30	> 30 ...100	> 100 ...300	> 300 ...1000	> 1000 ...3000
▱ —	0,1	0,2	0,4	0,8	1,2	1,6
⊥	0,6	0,6	0,6	1	1,5	2
=	0,6	0,6	0,6	1	1,5	2
/	0,5	0,5	0,5	0,5	0,5	0,5

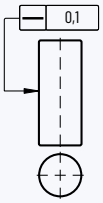
Circularity
The general tolerance for circularity is the minimum of the diameter tolerance and the general running tolerance.

Parallelism
The general tolerance for parallelism is the maximum of the measuring tolerance and the general tolerance for straightness and flatness.

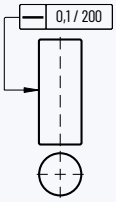
STRAIGHTNESS DIN ISO 1101



Definition: The tolerance zone is limited by two parallel planes a distance t apart.



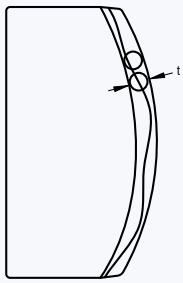
Example: Any line on the upper surface parallel to the plane of projection in which the indication is shown is to be contained between to parallel straight lines 0,1 apart.



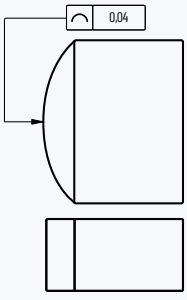
Any section of length 200 of any generatrix of the toleranced cylindrical surface must lie between two parallel straight lines of distance 0,1.

Note:
Further information on straightness tolerances see DIN ISO 1101.

PROFIL OF ANY LINE DIN ISO 1101

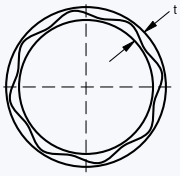


Definition: The tolerance zone is limited by two lines enveloping circles of diameter t 1 on the centres of which are situated on a line having the theoretically exact geometrical form.

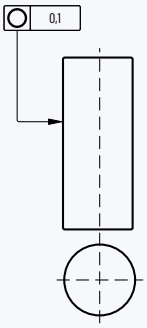


Example: In each section parallel to the plane of projection the considered profile is to be contained between two lines enveloping circles of diameter 0,04, the centres of which are situated on a line of theoretically exact geometrical profile.

CILINDRICITY DIN ISO 1101

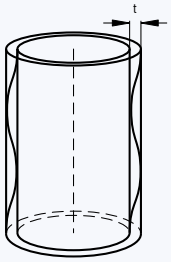


Definition: The tolerance zone in the considered plane is limited by two concentric circles at a distance t apart.

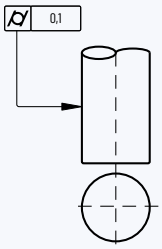


Example: The circumference of each crosssection is to be contained between two co-planar concentric circles 0,1 apart.

CILINDRICITY DIN ISO 1101

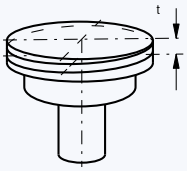


Definition: The tolerance zone is limited by two coaxial cylinders a distance t apart.

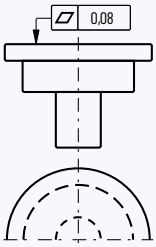


Example: The concidered surface is to be contained between two coaxial cylinders 0,1 apart.

FLATNESS DIN ISO 1101

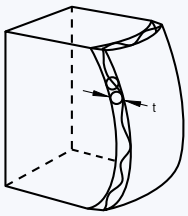


Definition: When projected on a plane the tolerance zone is limited by two parallel straight lines at a distance t apart.

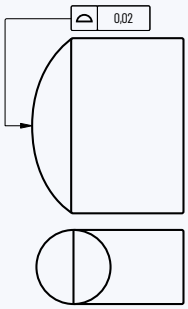


Example: The surface is to be contained between to parallel planes 0,08 apart.

PROFIL OF ANY SURFACE DIN ISO 1101

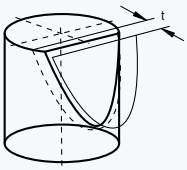


Definition: The tolerance zone is limited by two surfaces enveloping spheres of diameter t1 the centres of which are situated on a surface having the theoretically exact geometrical form.

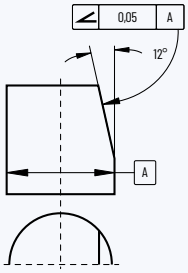


Example: The concidered surface is to be contained between to surlaces enveloping spheres of diameter 0,02, the centres of which are situated on a surface of theoretically exact geometrical form.

ANGULARITY DIN ISO 1101



Definition: The tolerance zone, when projected on a plane is limited by two parallel straight lines a distance t apart and inclined at the specified angle to the surface.



Example: The inclined surface is to be contained between to parallel planes 0,05 apart which are inclined at 12° to datum axis A.

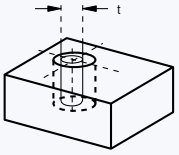
TOLERANCES FOR FORM AND POSITION

For **position tolerances** a **reference** point is required which gives the precise position of the tolerance zone. A reference point is a theoretically precise geometrical element (e.g. axis, plane straight line, etc). Reference points can be based on one or several **reference elements.**

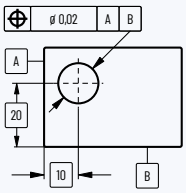
Within a tolerance zone **the element to be toleranced** can be in any form, any position or direction, bar any additional limiting factors.

For the **tolerance value** "t" the identical value as for length measurements is applicable. If nothing eise is specified the tolerance applies to the total length or area of the element to be toleranced.

POSITION DIN ISO 1101



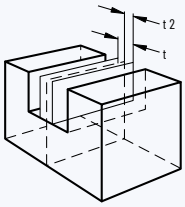
Definition: When the tolerance value is preceded by the diameter symbol the tolerance zone is limited by a cylinder of diameter t the axis of which is in the theoretically exact position of the considered line.



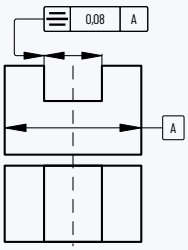
Example: The axis of the hole is to be contained within a cylindrical zone of dlameter 0,02 the axis of which is in the theoretically exact position of the considered line with reference to the datum surface A and B.

Note: For the positional tolerance of a point or a plane see DIN ISO 1101.

SYMMETRY DIN ISO 1101



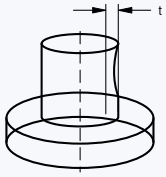
Definition: The tolerance zone is limited by two parallel planes a distance t apart and disposed symmetrically about the datum axis or datum median plane.



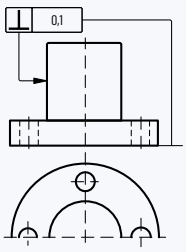
Example: The median plane of a slot is to be contained contained between two parallel planes which are 0,08 apart and symetrically disposed about the median plane of the datum feature A.

Note: For the symmetrical tolerance of a line or an axis see DIN ISO 1101.

PERPENDICULARITY DIN ISO 1101



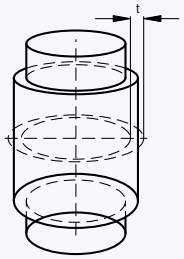
Definition: The tolerance zone when projected on a plane is limited by two parallel straight lines a distance t apart and perpendicular to the datum line.



Example: The axis of the cylinder is tobe contained between two parallel planes 0,1 apart, perpendicular to the datum surface.

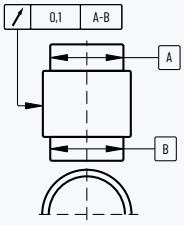
Note: For further perpendicular tolerancing see DIN ISO 1101.

PARALLELISM DIN ISO 1101



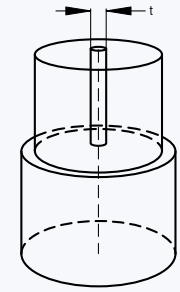
Definition: Within any plane of measurement perpendicular to the axis the tolerance zone is limited by two concentric circles a distance t apart, the centre of which coincides with the datum axis.

Example: The radial run-out is to be not greater than 0,1 in any plane of measurement during one revolution about the axis A-B.



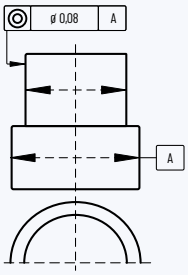
Note: When checking the measurement the work piece has to be rotated on its reference axis. For the plane run-out and radial run-out tolerance in any direction or to specified direction see DIN ISO 1101.

CONCENTRICITY | COAXIALITY DIN ISO 1101



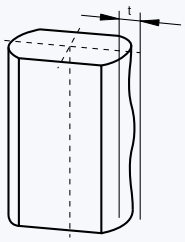
Definition: When the tolerance value is preceded by the diameter symbol the tolerance zone is limited by a cylinder of diameter t, the axis of which coincides with the datum axis.

Example: The axis of the cylinder is to be contained within a cylindrical zone of diameter 0,08 coaxial with the datum axis A



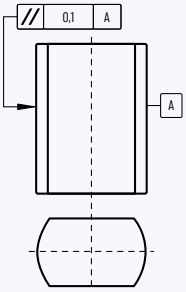
Note: Concentricity tolerance see DIN ISO 1101.

SYMMETRY DIN ISO 1101



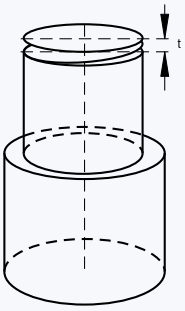
Definition: When the tolerance is specified In one directlon only, the tolerance zone when projected on a plane is lirnited by two parallel straight lines a dlstance t apart and parallel to the datum line

Example: The tolerance axis is to be contained between two straight lines 0,1 apart, which are parallel to the datum axis A and lie in the vertical directions.



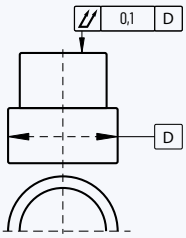
Note: For further parallelistic tolerancing see DIN ISO 1101.

TOTAL RUN-OUT DIN ISO 1101



Definition: The tolerance zone is limited by two parallel planes a distance t apart and perpendicular to the datum axis.

Example: The total run-out is to be no greater than 0,1 at any point on the specified surface whilst revolving about the datum axis D and with relative radial movement between the measuring instrument and the work-piece. With relative movement the measuring instrument of the work-piece is to be guided along a line having the theoretically exact form of the contour and being in its correct position relative to the datum axis.



Note: When measuring, the work-piece has to be turned several times on ist reference axis. Work-piece and gauge have to move radially in relation to each other.

For total run-out tolerance see DIN ISO 1101.