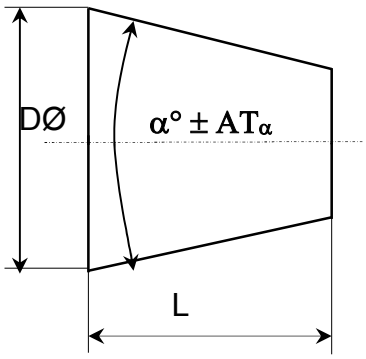
For new designs, the tolerances for linear and angular dimensions and for form and position without individual tolerance indications are specified in DIN ISO 2768 part 1 and part 2. The respective tolerance class is indicated in the drawing. DIN 7167 is valid for new designs regarding the connection between tolerances relating to dimension, form and parallelism if there is no reference to DIN ISO 8015 indicated in the drawing.

DIN ISO 2768 is not to be applied to cone angles in conical connections, centre distances, pin bore distances and crank radii.

Tolerances for cones in conical connections:

The following specifications apply to all cones defined in the drawing by the term "cone" and/or taper (e.g. cone 1:10):

Cone angle tolerance:



Cone length L	Cone angle tolerance AT_α	
	µrad	Seconds
10 to 16	400	1’22”
16 to 25	315	1’05”
25 to 40	250	52”
40 to 63	200	41”

2007088	Specification and assessment procedures added page 4-7; Envelope principles deleted page 1	RON 103_de_2007088.doc
2002451	Reference to DIN 7178 T1 deleted page 1.	RON 103_de 2002451.doc
9710	Update	
Edition	Description of change	Document

Created/Date ID/Ai 95 10 10	Assessed/Date QP/BUN 2009 03 04	Assessed/Date FT/STMA 2009 04 01	Replaced: edition 2002451
Changed 2009 01 26 AK/AI		Approved/Date AK/AI 2009 04 15	

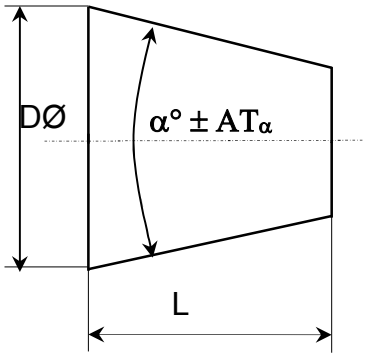
Roundness tolerance of cross-section and straightness tolerance of surface lines:

Cone diameter D	Roundness	straightness
10 to 18	4µm	4µm
18 to 30	5µm	5µm
30 to 50	6µm	6µm

Cone diameter D is the largest diameter of the respective cone

Larger deviations for the cone angle tolerance may be permissible in special cases (e.g. due to the easily deformed hub design on magnet wheels). These cones are indicated in the drawing by adding the suffix AT 7 to the cone specification (e.g. cone 1:7,5 AT 7).

Cone angle tolerance for grade AT 7 cones



Cone length L	Cone angle tolerance AT_α	
	µrad	Seconds
10 to 16	630	2’10”
16 to 25	500	1’43”
25 to 40	400	1’22”
40 to 63	315	1’05”

Centre distances:

The following applies to centre distances marked "A" in accordance with RON 100 in existing drawings:

Nominal dimension range	Up to 40	over 40 to 100	over 100 to 250	over 250 to 630
Permissible deviation	±0.022	±0.028	±0.036	±0.045

For **new designs,** the **dimensions for centre distances** and **parallelism tolerances for axes** are to be specified in the drawing in accordance with **DIN 3964**.

Recommended tolerance fields for common spur (cylindrical) gears:

Centre distance deviation: js8

Parallelism tolerances for axes : Precision class 8

Where stricter specifications apply, particularly in relation to noise prevention:

Centre distance deviation: js7/ js6

Pin bore distances:

As a rule, pin bores are specified in Cartesian coordinates, where a pin bore is a reference for all others. The permissible deviations for the coordinates correspond to the values for the centre distances marked "A" and are entered in the drawing.

Specification and assessment procedures relating to form and positional tolerances

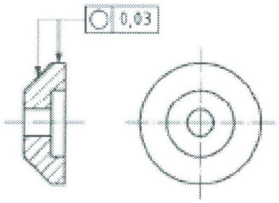
This section describes measuring and test procedures to be applied when in doubt for proving the fulfilment of various specifications indicated in drawings relating to form and positional tolerances.

In situation where it is compulsory to apply other procedures then these are to be documented in all relevant measurement report forms.

The procedures described here are also to be applied to all parts ordered subsequently using drawings based on suppliers' drawings, unless agreed otherwise in writing.

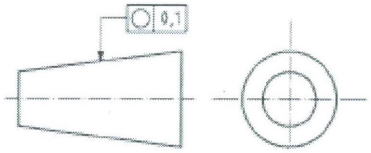
Roundness

The recorded (actual) peripheral line of the cross-section of the cylinder and the conical surface must lie between two concentric circles on the same plane with a radial gap of 0.03.

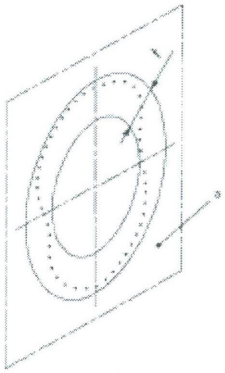


The recorded (actual) peripheral line of the cross-section of the conical surface must lie between two concentric circles on the same plane with a radial gap of 0.01.

NOTE: the definition of the peripheral line has not been standardised.



The tolerance zone in the cross section analysed is limited by the radial spacing of two concentric circles.



Cross sections

If the envelope condition applies, then the waves at any point on the surface of the form elements may not exceed the maximum geometric ideal form. At the same time, at no point may the actual value measured fall below the minimum specified dimension.

For bores, the surface of the geometric ideal form may not fall below the minimum dimension. In addition, at no point may the measurement exceed the maximum. (Not one single measuring point may lie outside this range.)

The roundness tolerance is thus only an additional limitation with the dimensional tolerance, providing the drawing does not specifically indicate the independence principle according to DIN ISO 8015.

Roundness is to be tested using electronic instrumentation (3D measuring machine, roundness test machine, etc.).
The following filters are to be applied:

Diameter of workpiece or bore [mm]	Threshold wave limit [waves per rotation]	Test points/circumference
bis 25	15	>105
>25 bis 80	50	>350
>80 bis 250	150	>1050
>250	500	>3500

The minimum ring zone is to be applied as a basis for the measurements.

Straightness/Flatness

This is to be tested using a 3D machine applying the following (λ_c-) filter

Threshold wavelength λ_c	Test points per mm	Step rate [mm]
0.80	>8.75	0.1143

Cylinders

Measured using radial section method

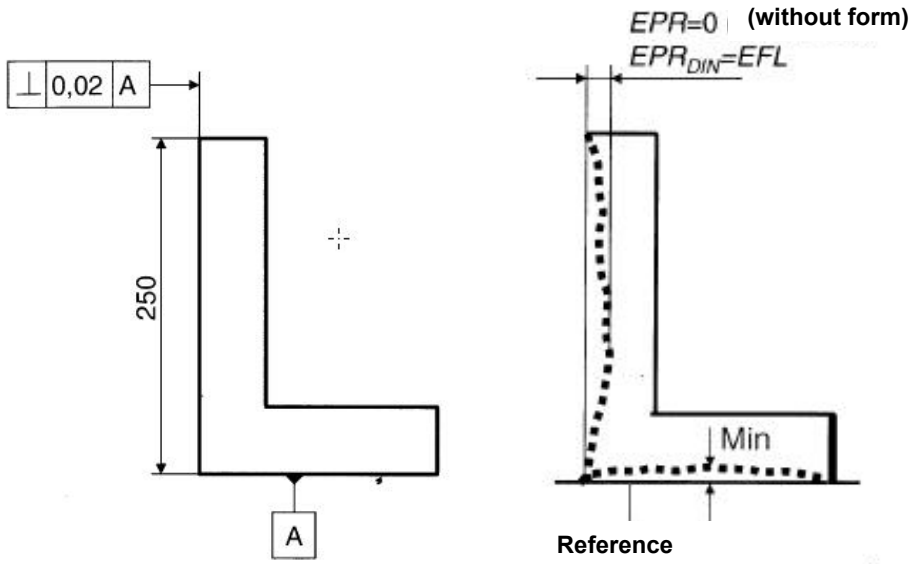
Bore/bolt length	Measuring levels*)	Comment
0 to 50	3 (start/end/middle)	*) minimum quantity of roundness measurements to be made over the full length of the cylinder. In addition, at least one extra roundness measurement is to be performed.
>50 bis 150	5 distributed evenly	
>100 bis 300	7 distributed evenly	

Positional tolerances

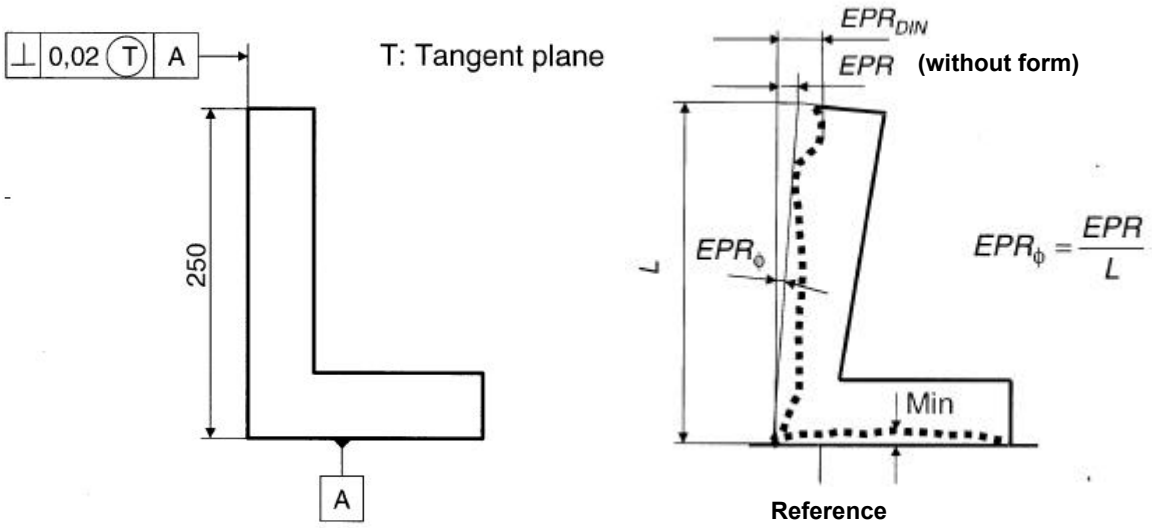
(Tolerances relating to angularity / position / parallelism / symmetry / true running / runout / overall run / concentricity)

Form tolerances of an element are to comply with DIN EN ISO 1101 as part of the positional tolerances and is limited to this standard.

Example of right-angle accuracy:



This does no correspond with the functional requirements of certain applications. The form deviation can be eliminated in such cases. This is specified as follows in the drawing: Example of right-angle accuracy



For the deviation from the right-angle a tangential plane is to be used instead of the surface with form defects.

Reference elements and correcting samples

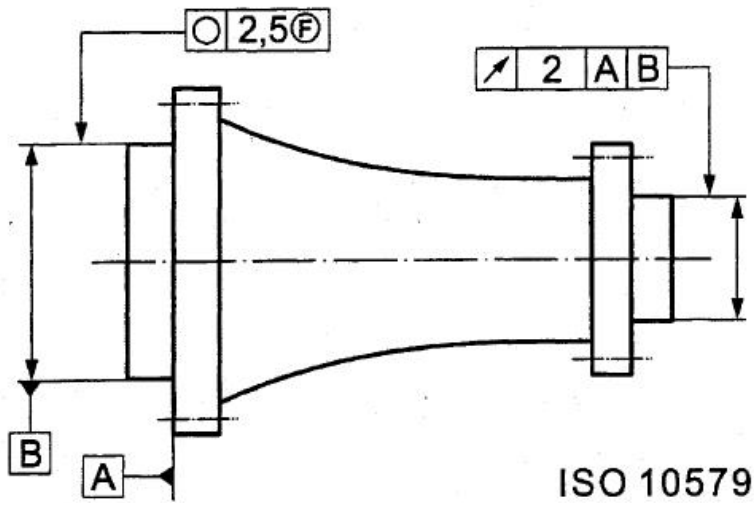
Form tolerances of a reference element are to comply with DIN ISO 5459 to eliminate the measurement of a positional tolerance.

Where a reference system is defined by reference elements, it is not permissible to correct the sample according to "best fit" methods. **"Best fit" methods are only permissible in exceptional situations on agreement from Rotax.**

Non form-stable parts

These are parts that become distorted under their own weight, or parts that can be brought into their specified form using "minimum effort" without risk of breakage.

If necessary, clamping conditions are to be defined in the drawing where the specified permissible deviation are not to be exceeded.



ISO 10579 - NR

Explanation:
The roundness tolerance marked **"F"** is to be met in an unclamped state. The tolerance that is not marked applies in the clamping conditions specified.

Clamping conditions: reference surface A is secured with 64 M6x1 bolts at a torque of 9 to 15 Nm. Reference element B is clamped to the corresponding maximum material limit.

7- 1

Standards specified:

DIN ISO 2768 General tolerances
DIN ISO 8015 Technical drawings; fundamental tolerancing principle
DIN 3964 Deviations of Shaft Centre Distances and Shaft Position Tolerances of Casings for Cylindrical Gears
DIN 7167 Relationship between tolerances of size, form, and parallelism
ISO 1101 Geometrical Product Specifications (GPS) - Geometrical tolerancing - Tolerances of form, orientation, location and run-out
DIN ISO 5459 Technical drawings; geometrical tolerancing; datums and datum-systems for geometrical tolerances
ISO 10579 Technical drawings; dimensioning and tolerancing; non-rigid parts
RON 100 Dimensions on drawings