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Acceptance conditions for general purpose parallel lathes — Testing of the accuracy

Conditions de réception des tours parallèles d'usage général — Contrôle de la précision

Reference number
ISO 1708 : 1989 (E)

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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 1708 was prepared by Technical Committee ISO/TC 39, *Machine tools.*

This fourth edition cancels and replaces the third edition (ISO 1708 : 1983), of which it constitutes a minor revision.

Annex A of this International Standard is for information only.

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Acceptance conditions for general purpose parallel lathes — Testing of the accuracy

1 Scope

This International Standard specifies, with reference to ISO 230-1, both geometrical and practical tests on general purpose parallel lathes, and gives the corresponding permissible deviations which apply.

It deals only with the verification of the accuracy of the machine. It does not apply to the testing of the running of the machine (vibrations, abnormal noises, stick-slip motion of components, etc.), or to the checking of machine characteristics (speeds, feeds, etc.,) which shall generally be checked before the accuracy is tested.

2 Normative reference

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

ISO 230-1 : 1986, *Acceptance code for machine tools — Part 1: Geometric accuracy of machines operating under no-load or finishing conditions.*

3 Preliminary remarks

3.1 In this International Standard, all dimensions and deviations are expressed in millimetres and in inches.

3.2 To apply this International Standard, reference shall be made to ISO 230-1, especially for the installation of the machine before testing, warming up of spindles and other moving parts, description of measuring methods and recommended accuracy of testing equipment.

3.3 The sequence in which the geometrical tests are given is related to the sub-assemblies of the machine, and this in no way defines the practical order of testing. In order to make the mounting of instruments or gauging easier, tests may be applied in any order.

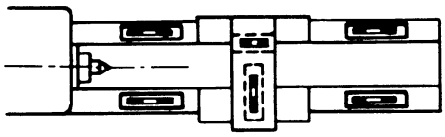
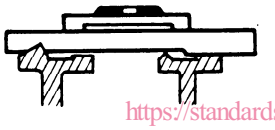
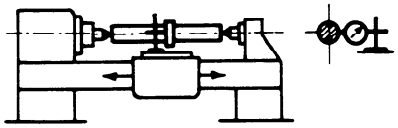
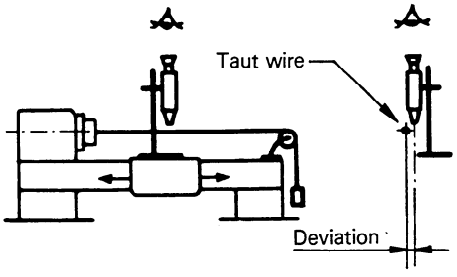
3.4 When inspecting a machine, it is not always necessary to carry out all the tests given in this International Standard. It is up to the user to choose, in agreement with the manufacturer, those tests relating to the properties which are of interest to him, but the agreed tests shall be clearly stated when ordering a machine.

3.5 Practical tests shall be made with finishing cuts [for instance, depth = 0,1 mm (0,004 in); feed = 0,1 mm (0,004 in) per revolution] and not with roughing cuts, which are liable to generate appreciable cutting forces.

3.6 When establishing the tolerance for a measuring range different from that indicated in this International Standard (see ISO 230-1 : 1986, 2.311) it should be taken into consideration that the minimum value of tolerance is 0,005 mm (0,000 2 in) for precision lathes and 0,01 mm (0,000 4 in) for other lathes.

4 Acceptance conditions and permissible deviations

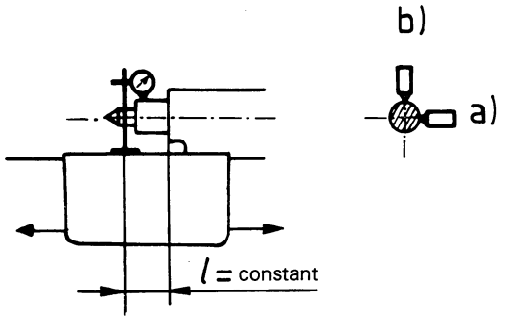
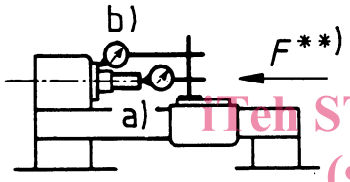
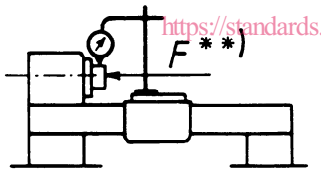
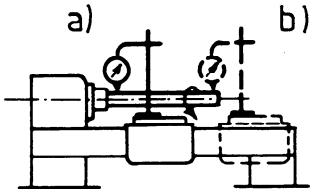
4.1 Geometrical tests

No.	Diagram	Object	Precision lathes	
			mm	in
			$D_a \leqslant 500$ and $DC \leqslant 1\,500$	$D_a \leqslant 20$ and $DC \leqslant 60$
G1	a) 	**A — Bed** Verification of levelling of slideways. a) Longitudinal verification: straightness of slideways in the vertical plane.	$DC \leqslant 500$ 0,01 (convex)	$DC \leqslant 20$ 0,000 4 (convex)
			$500 < DC \leqslant 1\,000$ 0,015 (convex) Local tolerance **): 0,005 over any measured length of 250	$20 < DC \leqslant 40$ 0,000 6 (convex) Local tolerance **): 0,000 2 over any measured length of 10
			$1\,000 < DC \leqslant 1\,500$ 0,02 (convex)	$40 < DC \leqslant 60$ 0,000 8 (convex)
	b) 		Local tolerance **): 0,005 over any measured length of 250	Local tolerance **): 0,000 2 over any measured length of 10
		b) Transverse verification: slideways shall be in the same plane.	b) Variation in level: 0,03/1 000	b) Variation in level: 0,001 2/40
G2	a) 	**B — Carriage** Checking of straightness of carriage movement in a horizontal plane or, possibly, in a plane defined by the axis of the centres and the tool point.	$DC \leqslant 500$ 0,01	$DC \leqslant 20$ 0,000 4
			$500 < DC \leqslant 1\,000$ 0,015	$20 < DC \leqslant 40$ 0,000 6
	b) 		$1\,000 < DC \leqslant 1\,500$ 0,02	$40 < DC \leqslant 60$ 0,000 8

*) DC = distance between centres.
D_a = maximum permissible diameter above the bed.

**) See clause 5.

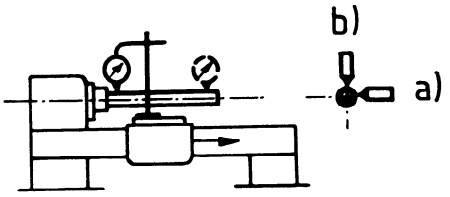
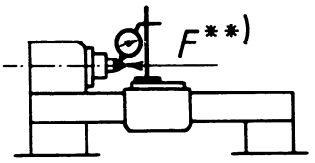
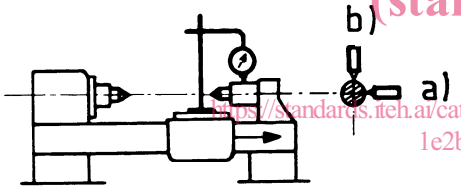
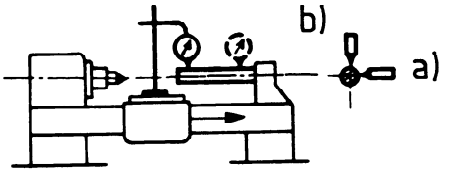
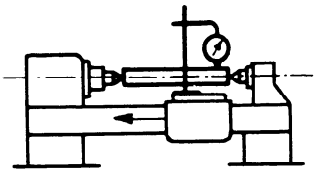
Permissible deviation *)				Measuring instruments	Observations and references to the ISO 230-1 : 1986 acceptance code
Other lathes					
mm		in			
$D_a \leqslant 800$	$800 < D_a \leqslant 1\,600$	$D_a \leqslant 32$	$32 < D_a \leqslant 64$		
$DC \leqslant 500$		$DC \leqslant 20$		Precision levels, optical or other methods	
0,01 (convex)	0,015 (convex)	0,000 4 (convex)	0,000 6 (convex)		
$500 < DC \leqslant 1\,000$		$20 < DC \leqslant 40$			
0,02 (convex)	0,03 (convex)	0,000 8 (convex)	0,001 2 (convex)		
Local tolerance **):		Local tolerance **):			
0,007 5	0,01	0,000 3	0,000 4		
over any measured length of 250		over any measured length of 10			
$DC > 1\,000$		$DC > 40$			a) Subclauses 3.11, 3.21, 5.212.21 and 5.212.22
For each 1 000 increase in distance between centres beyond 1 000, add to the corresponding preceding tolerance:		For each 40 increase in distance between centres beyond 40, add to the corresponding preceding tolerance:			Take measurements at a number of positions equally spaced along the length of the bed.
0,01	0,02	0,000 4	0,000 8		The levels may be placed on the transverse slide.
Local tolerance **):		Local tolerance **):			When the slideways are not horizontal, use a special straightedge as mentioned in subclause 5.212.21 (2°), figure 12.
0,015	0,02	0,000 6	0,000 8		
over any measured length of 500		over any measured length of 20			
b) Variation in level:		b) Variation in level:			b) Subclause 5.412.7
0,04/1 000		0,001 6/40		Precision levels	Place a level transversely on the slideways and take measurements at a number of positions equally spaced along the length of the slideways.
					The variation in level measured at any position shall not exceed the permissible deviation.
$DC \leqslant 500$		$DC \leqslant 20$		a) For $DC < 1\,500$ mm (< 60 in): dial gauge and mandrel between centres or straightedge	a) Subclause 5.232.3 a) or 5.232.1
0,015	0,02	0,000 6	0,000 8		Touch the front generatrix of the mandrel (instead of the mandrel, a straightedge with parallel faces may be used).
$500 < DC \leqslant 1\,000$		$20 < DC \leqslant 40$			The length of the mandrel between centres shall be as nearly as possible equal to the value of DC.
0,02	0,025	0,000 8	0,001		
$DC > 1\,000$		$DC > 40$		b) Whatever the value of DC, taut wire and microscope or optical methods	b) Subclauses 5.212.3 and 5.232.3 b)
For each 1 000 increase in distance between centres beyond 1 000, add to the corresponding preceding tolerance:		For each 40 increase in distance between centres beyond 40, add to the corresponding preceding tolerance:			The deviation in straightness of carriage movement shall, other than in exceptional cases, be concave relative to the axis of the centres.
0,005		0,000 2			
Maximum permissible deviation:		Maximum permissible deviation:			
0,03	0,05	0,001 2	0,002		

No.	Diagram	Object	Precision lathes	
			mm	in
			$D_a \leqslant 500$ and $DC \leqslant 1500$	$D_a \leqslant 20$ and $DC \leqslant 60$
G3		Checking of parallelism of tailstock movement to carriage movement: a) in the horizontal plane; b) in the vertical plane.	a) 0,02 Local tolerance: 0,01 over any measured length of 500 b) 0,03 Local tolerance: 0,02 over any measured length of 20	a) 0,000 8 Local tolerance: 0,000 4 over any measured length of 20 b) 0,001 2 Local tolerance: 0,000 8 over any measured length of 20
G4		**C — Headstock spindle** a) Measurement of periodic axial slip. b) Measurement of camming of the face plate resting surface.	a) 0,005 b) 0,01 including periodic axial slip	a) 0,000 2 b) 0,000 4 including periodic axial slip
G5		Measurement of run-out of spindle nose centring sleeve.	0,007	0,000 3
G6		Measurement of run-out of axis of centre: a) at the spindle nose of the housing; b) at a distance from the spindle nose equal to $D_a/2$ or not more than 300 mm (12 in)[1].	a) 0,005 b) 0,015 for a measuring length of 300 0,01 for a measuring length of 200 0,005 for a measuring length of 100	a) 0,000 2 b) 0,000 6 for a measuring length of 12 0,000 4 for a measuring length of 8 0,000 2 for a measuring length of 4

*) DC = distance between centres.
D_a = maximum permissible diameter above the bed.

**) F = constant pressure on headstock spindle to eliminate axial bearing end play.

Permissible deviation *)				Measuring instruments	Observations and references to the ISO 230-1 : 1986 acceptance code
Other lathes					
mm		in			
$D_a < 800$	$800 < D_a < 1\,600$	$D_a < 32$	$32 < D_a < 64$		
$DC < 1\,500$ a) and b) 0,03	$DC < 1\,500$ a) and b) 0,04	$DC < 60$ a) and b) 0,001 2	$DC < 60$ a) and b) 0,001 6	Dial gauge	Subclause 5.422.5 With the tailstock as close as possible to the carriage take the readings when both are moved together; keep the tailstock sleeve locked so that the dial gauge fixed on the carriage always touches the same point.
Local tolerance: 0,02 over any measured length of 500		Local tolerance: 0,000 8 over any measured length of 20			
$DC > 1\,500$ a) and b) 0,04 Local tolerance: 0,03 over any measured length of 500		$DC > 60$ a) and b) 0,001 6 Local tolerance: 0,001 2 over any measured length of 20			
a) 0,01 b) 0,02 including periodic axial slip	a) 0,015 b) 0,02 including periodic axial slip	a) 0,000 4 b) 0,000 8 including periodic axial slip	a) 0,000 6 b) 0,000 8 including periodic axial slip	Dial gauge and, possibly, a special device	Subclauses 5.62, 5.621.2, 5.622.2 and 5.632 For the position of the dial gauge, see subclauses 5.62, 5.622 and 5.623, figures 59 to 64 and 67. The value of force F to be applied for the tests a) and b) shall be specified by the manufacturer.
0,01	0,015	0,000 4	0,000 6	Dial gauge	Subclauses 5.612.2 and 5.621.2 The value of force F to be applied shall be specified by the manufacturer. In the case of a tapered spindle nose, fix the dial gauge perpendicular to the generating line of the taper.
a) 0,01 b) 0,02 for a measuring length of 300	a) 0,015 b) 0,05 for a measuring length of 500	a) 0,000 4 b) 0,000 8 for a measuring length of 12	a) 0,000 6 b) 0,002 for a measuring length of 20	Dial gauge and test mandrel	Subclause 5.612.3 1) For lathes such that $D_a > 800$ mm (32 in), the measuring length might be increased up to 500 mm (20 in).

No.	Diagram	Object	Precision lathes	
			mm	in
			D_a < 500 and DC < 1500	D_a < 20 and DC < 60
G7		Checking of parallelism of spindle axis to carriage longitudinal movement on a length equal to $D_a/2$ or a maximum equal to 300 mm (12 in)[1]: a) in the horizontal plane; b) in the vertical plane.	a) 0,01/300 frontwards b) 0,02/300 upwards	a) 0,000 4/12 frontwards b) 0,000 8/12 upwards
G8		Measurement of run-out of headstock centre.	0,01	0,000 4
G9		**D — Tailstock** Checking of parallelism of the axis of the outside of tailstock sleeve to carriage movement: a) in the horizontal plane; b) in the vertical plane.	a) 0,01/100 frontwards b) 0,015/100 upwards	a) 0,000 4/4 frontwards b) 0,000 6/4 upwards
G10		Checking of parallelism of taper bore of sleeve to carriage movement on a length equal to $D_a/4$ or a maximum equal to 300 mm (12 in)[1]: a) in the horizontal plane; b) in the vertical plane.	a) 0,02/300 frontwards b) 0,02/300 upwards	a) 0,000 8/12 frontwards b) 0,000 8/12 upwards
G11		**E — Centres** Checking of difference in height between headstock centre and tailstock centre.	0,02 Tailstock centre higher than headstock centre	0,000 8 Tailstock centre higher than headstock centre

*) DC = distance between centres.
D_a = maximum permissible diameter above the bed.

**) F = constant pressure on headstock spindle to eliminate axial bearing end play.

Permissible deviation *)				Measuring instruments	Observations and references to the ISO 230-1 : 1986 acceptance code
Other lathes					
mm		in			
$D_a \leq 800$	$800 < D_a \leq 1\,600$	$D_a \leq 32$	$32 < D_a \leq 64$		
a) 0,015/300 frontwards b) 0,02/300 upwards	a) 0,03/500 frontwards b) 0,04/500 upwards	a) 0,000 6/12 frontwards b) 0,000 8/12 upwards	a) 0,001 2/20 frontwards b) 0,001 6/20 upwards	Dial gauge and test mandrel	Subclauses 5.412.1 and 5.422.3 1) For lathes such that $D_a > 800$ mm (32 in), the measuring length might be increased up to 500 mm (20 in).
0,015	0,02	0,000 6	0,000 8	Dial gauge	Subclauses 5.612.2 and 5.621.2 The dial gauge being placed perpendicularly to the taper surface of the head centre, and tolerance being given in a plane perpendicular to the spindle axis, divide the readings observed by cos α, α being the semi cone angle of the taper. The value of force F to be applied shall be specified by the manufacturer.
a) 0,015/100 frontwards b) 0,02/100 upwards	a) 0,02/100 frontwards b) 0,03/100 upwards	a) 0,000 6/4 frontwards b) 0,000 8/4 upwards	a) 0,000 8/4 frontwards b) 0,001 2/4 upwards	Dial gauge	Subclause 5.422.3 After the tailstock sleeve has been sufficiently extended, it shall be locked as under normal working conditions.
a) 0,03/300 frontwards b) 0,03/300 upwards	a) 0,05/500 frontwards b) 0,05/500 upwards	a) 0,001 2/12 frontwards b) 0,001 2/12 upwards	a) 0,002/20 frontwards b) 0,002/20 upwards	Dial gauge and test mandrel	Subclause 5.422.3 Lock the tailstock sleeve as under normal working conditions. 1) For lathes such that $D_a > 800$ mm (32 in), the measuring length might be increased up to 500 mm (20 in).
0,04 Tailstock centre higher than headstock centre	0,06	0,001 6 Tailstock centre higher than headstock centre	0,002 4	Dial gauge and test mandrel	Subclause 5.422.3 Touch the top generatrix of the mandrel. Take readings at the extremities of the test mandrel with the tailstock and tailstock sleeve locked, as under normal working conditions.