ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION

R 1708

TEST CONDITIONS

FOR GENERAL PURPOSE PARALLEL LATHES

TESTING OF THE ACCURACY

1st EDITION

April 1970

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BRIEF HISTORY

The ISO Recommendation R 1708, *Test conditions for general purpose parallel lathes – Testing of the accuracy*, was drawn up by Technical Committee ISO/TC 39, *Machine tools*, the Secretariat of which is held by the Association Française de Normalisation (AFNOR).

Work on this question led to the adoption of Draft ISO Recommendation No. 1708 which was circulated to all the ISO Member Bodies for enquiry in October 1968. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

Australia	India	South Africa, Rep. of
Austria	Israel	Spain
Belgium	Italy	Sweden
Brazil	Japan	Switzerland
Chile	Korea, Rep. of	Thailand
Czechoslovakia	Netherlands	Turkey
France	New Zealand	United Kingdom
Germany	Poland	U.S.A.
Greece	Portugal	
Hungary	Romania	

No Member Body opposed the approval of the Draft.

This Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in April 1970, to accept it as an ISO RECOMMENDATION.

CONTENTS

TEST CONDITIONS

FOR GENERAL PURPOSE PARALLEL LATHES

TESTING OF THE ACCURACY

1. SCOPE

This ISO Recommendation describes, with reference to ISO Recommendation R 230, *Machine tool test code*, both geometrical and practical tests on general purpose parallel lathes, and gives the corresponding permissible deviations which apply.
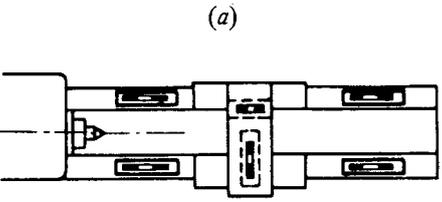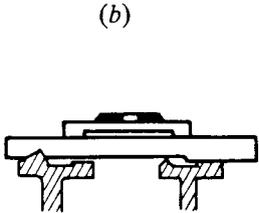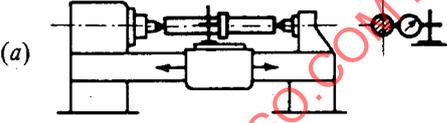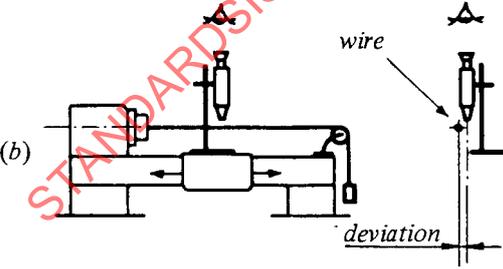
It deals only with the verification of accuracy of the machine. It does not apply to the testing of the running of the machine (vibrations, abnormal noises, stick-slip motion of components, etc.), or to characteristics (speeds, feeds, etc.) which should generally be checked before testing accuracy.

2. PRELIMINARY REMARKS

2.1   In this ISO Recommendation, all the dimensions are expressed in millimetres in section 3 and in inches in section 4.

2.2   To apply this ISO Recommendation, reference should be made to ISO Recommendation R 230, especially for installation of the machine before testing, warming up of spindles and other moving parts, description of measuring methods and recommended accuracy of testing equipment.

2.3   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.

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

2.5   Practical tests should 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.

2.6   When establishing the tolerance for a measuring range different from that indicated in this ISO Recommendation (see clause 2.311 in ISO Recommendation R 230) it should be taken into consideration that the minimum value of tolerance is 0.005 mm (0.0002 in) for precision lathes and 0.010 mm (0.0004 in) for other lathes.

3. TEST CONDITIONS AND PERMISSIBLE DEVIATIONS

3.1 Geometrical tests

No.	Diagram	Object	Precision lathe $Da \leqslant 500$ and $DC \leqslant 1500$
G 1	(a) (b)	**A – BED** Inspection of the straightness of the slideways : (a) Longitudinal inspection : straightness of the slideways in the vertical plane;	$DC \leqslant 500$ 0.01 (convex) $500 < DC \leqslant 1000$ 0.015 (convex) Local tolerance** : 0.005 for any length of 250 $1000 < DC \leqslant 1500$ 0.02 (convex) Local tolerance** : 0.005 for any length of 250.
		(b) Transverse inspection : slideways should be in the same plane.	Variation of level : 0.03/1000
G 2	(a) (b) *wire* *deviation*	**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 $500 < DC \leqslant 1000$ 0.015 $1000 < DC \leqslant 1500$ 0.02

* DC = distance between centres.

Da = maximum permissible diameter.

** See section 5, page 27.

Dimensions in millimetres

Permissible deviation*		Measuring instruments	Observations and references to the test code ISO/R 230
Other lathes			
$Da \leqslant 800$	$800 < Da \leqslant 1600$		
$DC \leqslant 500$		Precision levels, optical or other methods	Clause 3.11. (It is reminded that this test cannot be separated from the levelling operation). Clauses 5.212.21 and 5.212.22. Measurements should be made at positions equally distributed throughout the length of the bed. The levels may be placed on the transverse slide. When the slideways are not horizontal, use a special straightedge as mentioned in Figure 12 of clause 5.212.21 (2°).
0.01 (convex)	0.015 (convex)		
$500 < DC \leqslant 1000$			
0.02 (convex)	0.03 (convex)		
Local tolerance** :			
0.0075	0.01		
for any length of 250			
$DC > 1000$			
For each 1000 increase in distance between centres beyond 1000, add to the corresponding preceding tolerance :			
0.01	0.02		
Local tolerance** :			
0.015	0.02		
for any length of 500			
Variation of level : 0.04/1000		Precision levels	A level should be placed transversely on the slideways and measurements taken at a number of positions equally spaced along the length of the slideways. The variation of level measured at any position should not exceed the permissible deviation.
$DC \leqslant 500$		(a) For $DC < 1500$, dial gauge and mandrel between centres or straightedge	(a) clause 5.232.3 (a) or 5.232.1. Touch the front generatrix of the mandrel (instead of the mandrel, a straightedge with parallel faces may be used). Length of mandrel between centres should be as nearly as possible equal to the value of DC.
0.015	0.02		
$500 < DC \leqslant 1000$			
0.02	0.025		
$DC > 1000$		(b) Whatever the value of DC, taut wire and microscope or optical methods	(b) clauses 5.212.3 and 5.232.3 (b). The deviation of straightness of carriage movement should, other than in exceptional cases, be concave relative to the axis of the centres.
For each 1000 increase in distance between centres beyond 1000, add to the corresponding preceding tolerance :			
0.005			
Maximum permissible deviation :			
0.03	0.05		

No.	Diagram	Object	Precision lathes
			$Da \leqslant 500$ and $DC \leqslant 1500$
G 3	(b) (a) $l = constant$	Checking of parallelism of tailstock to carriage movements : (a) in the horizontal plane; (b) in the vertical plane.	(a) 0.02 Local tolerance : 0.01 for any length of 500 (b) 0.03 Local tolerance : 0.02 for any length of 500
G 4	(b) F^{**} (a)	**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
G 5	F^{**}	Measurement of run-out of spindle nose centring sleeve	0.007
G 6	(a) (b)	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 $\dfrac{Da}{2}$ or not more than 300[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

* DC = distance between centres.

 Da = maximum permissible diameter.

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

Dimensions in millimetres

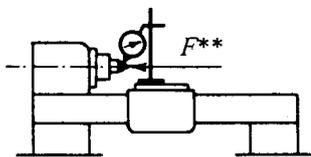| Permissible deviation*		Measuring instruments	Observations and references to the test code ISO/R 230
Other lathes			
$Da \leqslant 800$	$800 < Da \leqslant 1600$		
$DC \leqslant 1500$ (a) and (b) 0.03	$DC \leqslant 1500$ (a) and (b) 0.04	Dial gauge	Clause 5.422.5. With the tailstock as close as possible to the carriage, readings are made when both are moved together; the tailstock sleeve should remain locked so that the dial gauge fixed on the carriage always touches the same point.
Local tolerance : 0.02 for any length of 500			
$DC > 1500$ (a) and (b) 0.04			
Local tolerance : 0.03 for any length of 500			
(a) 0.01 (b) 0.02	(a) 0.015 (b) 0.02 including periodic axial slip	Dial gauge and, possibly, a special device	Clauses 5.62, 5.621.2, 5.622.2 and 5.632. For the position of the dial gauge, see Figures 59 to 64 and 67 of clauses 5.62, 5.622 and 5.632. The value of force F to be applied for the tests (a) and (b) should be specified by the manufacturer.
0.01	0.015	Dial gauge	Clauses 5.612.2 and 5.621.2. The value of force F to be applied should be specified by the manufacturer. In the case of a tapered spindle nose, the dial gauge should be placed 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	Dial gauge and test mandrel	Clause 5.612.3. [1] For lathes such as $Da > 800$, the measuring length might be increased up to 500.

No.	Diagram	Object	Precision lathes
			$Da \leqslant 500$ and $DC \leqslant 150($
G 7		Checking of parallelism of spindle axis to carriage longitudinal movement on a length equal to $\frac{Da}{2}$ or a maximum equal to 300[1] : (a) in the horizontal plane; (b) in the vertical plane.	(a) 0.01/300 frontwards (b) 0.02/300 upwards
G 8		Measurement of run-out of centre.	0.01
G 9		**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
G 10		Checking of parallelism of taper bore of sleeve to carriage movement on a length equal to $\frac{Da}{4}$ or a maximum equal to 300[1] : (a) in the horizontal plane; (b) in the vertical plane.	(a) 0.02/300 frontwards (b) 0.02/300 upwards
G 11		**E – CENTRES** Checking of difference in height between headstock and tailstock centres.	0.02 Tailstock centre higher than headstock centre
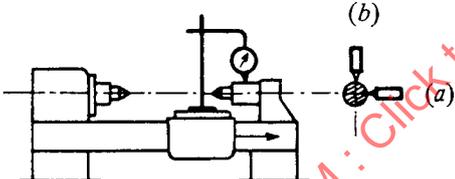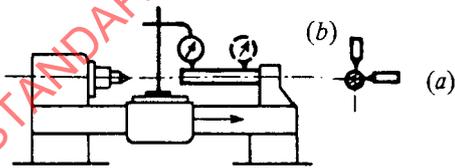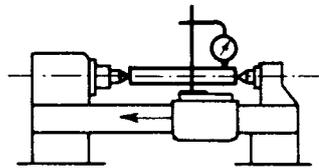
* DC = distance between centres.

   Da = maximum permissible diameter.

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

Dimensions in millimetres

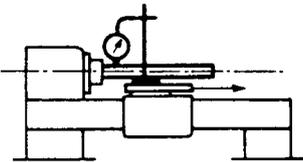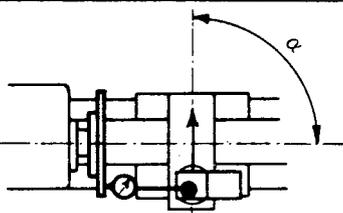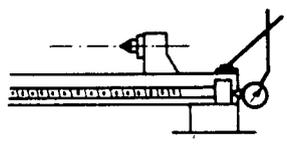| Permissible deviation*		Measuring instruments	Observations and references to the test code ISO/R 230
Other lathes			
$Da \leqslant 800$	$800 < Da \leqslant 1600$		
(a) 0.015/300 frontwards (b) 0.02/300 upwards	(a) 0.03/500 frontwards (b) 0.04/500 upwards	Dial gauge and test mandrel	Clauses 5.412.1 and 5.422.3. [1] For lathes such as $Da > 800$, the measuring length might be increased up to 500.
0.015	0.02	Dial gauge	Clauses 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, the readings observed should be divided by cos α, α being the semi cone angle of the taper. The value of force F to be applied should 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	Dial gauge	Clause 5.422.3. After the tailstock sleeve has been sufficiently extended, it should 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	Dial gauge and test mandrel	Clause 5.422.3. The tailstock sleeve should be locked as under normal working conditions. [1] For lathes such as $Da > 800$, the measuring length might be increased up to 500.
0.04	0.06	Dial gauge and test mandrel	Clause 5.422.3. Touch the top generatrix of the mandrel. Readings should be taken at the extremities of the test mandrel with the tailstock and tailstock sleeve locked, as under normal working conditions.
Tailstock centre higher than headstock centre			

No.	Diagram	Object	Precision lathes
			$Da \leqslant 500$ and $DC \leqslant 1500$
G 12		**F – UPPER SLIDE** Checking of parallelism of the longitudinal movement of the upper slide to the spindle axis.	0.015/150
G 13		**G – CROSS SLIDE** Checking of squareness of the transverse movement of the cross slide to the spindle axis.	0.01/300 Direction of deviation : $\alpha \geqslant 90°$
G 14		**H – LEAD SCREW** Measurement of periodic axial slip due to camming of each thrust bearing.	0.01
G 15		Measurement of the accuracy of the pitch generated by the lead screw.	(a) 0.03 For any measured length of 300 (b) 0.01 For any measured length of 50

* $DC =$ distance between centres.

     $Da =$ maximum permissible diameter.

Dimensions in millimetres

Permissible deviation*		Measuring instruments	Observations and references to the test code ISO/R 230
Other lathes			
$Da \leqslant 800$	$800 < Da \leqslant 1600$		
0.04/300		Dial gauge and test mandrel	Clause 5.422.3. Measurement should be made in the vertical plane (after setting up the upper slide parallel with the spindle axis in the horizontal plane), only in the working position of the upper slide.
0.02/300 Direction of deviation : $\alpha \geqslant 90°$		Dial gauge and flat disk or straightedge	Clauses 5.522.3 and 3.22.
0.015	0.02	Dial gauge	Clauses 5.622.1 and 5.622.2. This operation may be deleted if practical test P3 is carried out.
(a) $DC \leqslant 2000$ 0.04 For any measured length of 300 $DC > 2000$ For each 1000 increase in distance between centres beyond 2000, add to the corresponding preceding tolerance : 0.005 Maximum permissible deviation : 0.05 (b) 0.015 for any measured length of 50			Clauses 6.1 and 6.2. *Precision lathes.* A record of the pitch accuracy will be made by means of an electric pick-up, for instance, feeling the flanks of the threads of a master lead screw of 300 mm length held between centres. *Other lathes.* Length bars will be used associated with a dial gauge so as to compare the carriage travel to the number of corresponding revolutions of the spindle. However, for both classes of lathes, a record of the lead screw accuracy (over a specified length and checked along four generators shifted 90° forward) should be satisfactory.

3.2 Practical tests

No.	Diagram	Nature of test	Cutting conditions	Checks to be applied
P 1		Machining of cylindrical pieces** held in a chuck (the cylindrical piece may be inserted in the taper of the spindle), $D \geqslant \dfrac{Da}{8}$ $L = 0.5\,Da$ L max. $= 500$	Machining of two diameters on a cylinder over a maximum length of 20.	(a) roundness (b) cylindricity Any taper should be such that the major diameter is near the headstock centre.
P 2		Machining of cylindrical pieces** held in a chuck $D \geqslant 0.5\,Da$ $L = \dfrac{Da}{8}$ max.	Facing of flat surfaces perpendicular to the spindle (facing only two or three surfaces, one of which is central).	Surface flatness. Deviation of flatness should only be allowed in a concave direction.
P 3		Threading of a cylindrical piece** $L = 300$ ISO triangular thread (ISO Recommendation R 68).	The start of the screw thread is taken from any point on the lead screw. Diameter and pitch should be as close as possible to those of the lead screw.	Accuracy of the pitch.
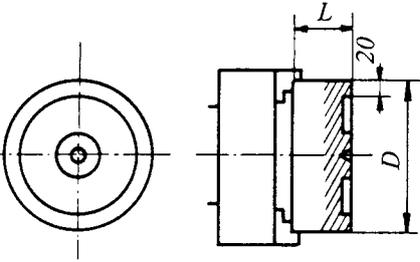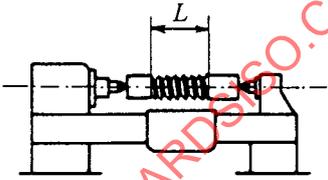
* $DC =$ distance between centres.

   $Da =$ maximum permissible diameter.

** Test pieces are made of steel or cast iron.

Dimensions in millimetres

Permissible deviation*			Measuring instruments	Observations and references to the test code ISO/R 230
Precision lathes	Other lathes			
$Da \leqslant 500$ and $DC \leqslant 1500$	$Da \leqslant 800$	$800 < Da \leqslant 1600$		
(a)　0.007 (b)　0.02 for $L = 300$	(a)　0.01 (b)　0.04 for $L = 300$	(a)　0.02 (b)　0.04	Micrometer or precise testing equipment	Clauses 3.1 and 3.22 4.1 and 4.2
0.015 for a diameter of 300	0.025 for a diameter of 300		Straightedge and slip gauges	Clauses 3.1 and 3.22 4.1 and 4.2
(a)　0.03 for any measured length of 300 (b)　0.01 for any measured length of 50	$DC \leqslant 2000$ (a)　0.04 for any measured length of 300 $DC > 2000$ For each 1000 increase in distance between centres beyond 2000, add to the corresponding preceding tolerance : 0.005 Maximum permissible deviation : 0.05 (b)　0.015 for any measured length of 50		Special instruments of tested precision	Clauses 3.1 and 3.22 4.1 and 4.2 6.1 and 6.2 The screw thread should be clean without flats or waviness.

4. TEST CONDITIONS AND PERMISSIBLE DEVIATIONS

4.1 Geometrical tests

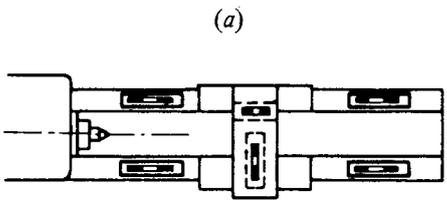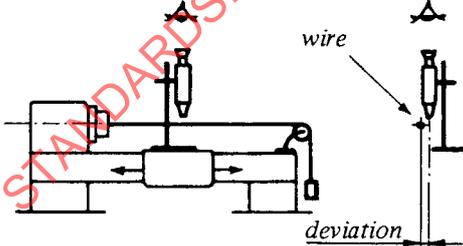| No.	Diagram	Object	Precision lathe $Da \leqslant 20$ and $DC \leqslant 60$
G 1	(a) (b)	**A – BED** Inspection of the straightness of the slideways : (a) Longitudinal inspection : straightness of the slideways in the vertical plane;	$DC \leqslant 20$ 0.0004 (convex) $20 < DC \leqslant 40$ 0.0006 (convex) Local tolerance** : 0.0002 for any length of 10 $40 < DC \leqslant 60$ 0.0008 (convex) Local tolerance** : 0.0002 for any length of 10
		(b) Transverse inspection : slideways should be in the same plane.	Variation of level : 0.0012/40
G 2	(a) (b) *wire* *deviation*	**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.	$DC \leqslant 20$ 0.0004 $20 < DC \leqslant 40$ 0.0006 $40 < DC \leqslant 60$ 0.0008

* DC = distance between centres.
Da = maximum permissible diameter.

** See section 5, page 27.

Dimensions in inches

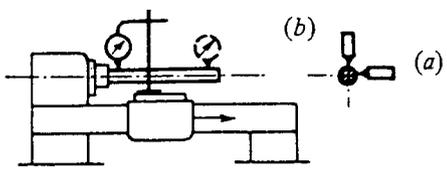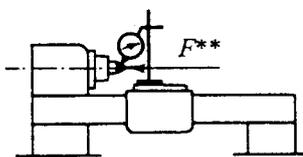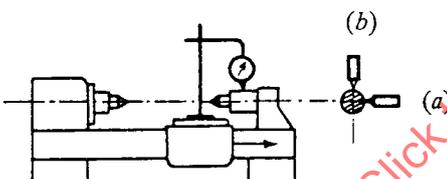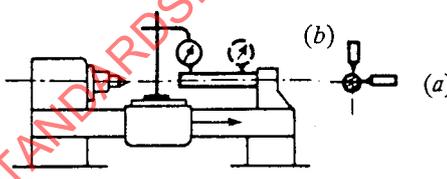| Permissible deviation*		Measuring instruments	Observations and references to the test code ISO/R 230
Other lathes			
$Da \leqslant 32$	$32 < Da \leqslant 64$		
$DC \leqslant 20$		Precision levels, optical or other methods	Clause 3.11. (It is reminded that this test cannot be separated from the levelling operation). Clauses 5.212.21 and 5.212.22. Measurements should be made at positions equally distributed throughout the length of the bed. The levels may be placed on the transverse slide. When the slideways are not horizontal, use a special straightedge as mentioned in Figure 12 of clause 5.212.21 (2°).
0.0004 (convex)	0.0006 (convex)		
$20 < DC \leqslant 40$			
0.0008 (convex)	0.0012 (convex)		
Local tolerance** :			
0.0003	0.0004		
for any length of 10			
$DC > 40$			
For each 40 increase in distance between centres beyond 40, add to the corresponding preceding tolerance :			
0.0004	0.0008		
Local tolerance** :			
0.0006	0.0008		
for any length of 20			
Variation of level : 0.0016/40		Precision levels	A level should be placed transversely on the slideways and measurements taken at a number of positions equally spaced along the length of the slideways. The variation of level measured at any position should not exceed the permissible deviation.
$DC \leqslant 20$		(a) For $DC < 60$, dial gauge and mandrel between centres or straightedge	(a) clause 5.232.3 (a) or 5.232.1. Touch the front generatrix of the mandrel (instead of the mandrel, a straightedge with parallel faces may be used). Length of mandrel between centres should be as nearly as possible equal to the value of DC.
0.0006	0.0008		
$20 < DC \leqslant 40$			
0.0008	0.0010		
$DC > 40$		(b) Whatever the value of DC, taut wire and microscope or optical methods	(b) clauses 5.212.3 and 5.232.3 (b). The deviation of straightness of carriage movement should, other than in exceptional cases, be concave relative to the axis of the centres.
For each 40 increase in distance between centres beyond 40, add to the corresponding preceding tolerance :			
0.0002			
Maximum permissible deviation :			
0.0012	0.0020		

| No. | Diagram | Object | Precision lathes |
			$Da \leqslant 20$ and $DC \leqslant 60$
G 3		Checking of parallelism of tailstock to carriage movements : (*a*) in the horizontal plane; (*b*) in the vertical plane.	(*a*) 0.0008 Local tolerance : 0.0004 for any length of 20 (*b*) 0.0012 Local tolerance : 0.0008 for any length of 20
G 4		**C – HEADSTOCK SPINDLE** (*a*) Measurement of periodic axial slip; (*b*) Measurement of camming of the face plate resting surface.	(*a*) 0.0002 (*b*) 0.0004 including periodic axial slip
G 5		Measurement of run-out of spindle nose centring sleeve	0.0003
G 6		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 $\dfrac{Da}{2}$ or not more than 12 [1].	(*a*) 0.0002 (*b*) 0.0006 for a measuring length of 12 0.0004 for a measuring length of 8 0.0002 for a measuring length of 4

* DC = distance between centres.

    Da = maximum permissible diameter.

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

Dimensions in inches

Permissible deviation*		Measuring instruments	Observations and references to the test code ISO/R 230
Other lathes			
$Da \leqslant 32$	$32 < Da \leqslant 64$		
$DC \leqslant 60$ (a) and (b) 0.0012 (a) and (b) 0.0016 Local tolerance : 0.0008 for any length of 20 $DC > 60$ (a) and (b) 0.0016 Local tolerance : 0.0012 for any length of 20		Dial gauge	Clause 5.422.5. With the tailstock as close as possible to the carriage, readings are made when both are moved together; the tailstock sleeve should remain locked so that the dial gauge fixed on the carriage always touches the same point.
(a) 0.0004 (b) 0.0004	(a) 0.0006 (b) 0.0008	Dial gauge and, possibly, a special device	Clauses 5.62, 5.621.2, 5.622.2 and 5.632. For the position of the dial gauge, see Figures 59 to 64 and 67 of clauses 5.62, 5.622 and 5.632. The value of force F to be applied for the tests (a) and (b) should be specified by the manufacturer.
including periodic axial slip			
0.0004	0.0006	Dial gauge	Clauses 5.612.2 and 5.621.2. The value of force F to be applied should be specified by the manufacturer. In the case of a tapered spindle nose, the dial gauge should be placed perpendicular to the generating line of the taper.
(a) 0.0004 (b) 0.0008 for a measuring length of 12	(a) 0.0006 (b) 0.0020 for a measuring length of 20	Dial gauge and test mandrel	Clause 5.612.3. [1] For lathes such as $Da > 32$, the measuring length might be increased up to 20.

No.	Diagram	Object	Precision lathes
			$Da \leqslant 20$ and $DC \leqslant 60$
G 7	*(b)* *(a)*	Checking of parallelism of spindle axis to carriage longitudinal movement on a length equal to $\dfrac{Da}{2}$ or a maximum equal to $12^{(1)}$: *(a)* in the horizontal plane; *(b)* in the vertical plane.	*(a)* 0.0004/12 frontwards *(b)* 0.0008/12 upwards
G 8	F^{**}	Measurement of run-out of centre.	0.0004
G 9	*(b)* *(a)*	**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)* 0.0004/4 frontwards *(b)* 0.0006/4 upwards
G 10	*(b)* *(a)*	Checking of parallelism of taper bore of sleeve to carriage movement on a length equal to $\dfrac{Da}{4}$ or a maximum equal to $12^{(1)}$: *(a)* in the horizontal plane; *(b)* in the vertical plane.	*(a)* 0.0008/12 frontwards *(b)* 0.0008/12 upwards
G 11		**E – CENTRES** Checking of difference in height between headstock and tailstock centres.	0.0008 Tailstock centre higher than headstock centre
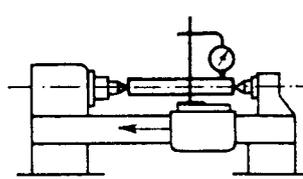
* DC = distance between centres.

    Da = maximum permissible diameter.

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

Dimensions in inches

Permissible deviation*		Measuring instruments	Observations and references to the test code ISO/R 230
Other lathes			
$Da \leqslant 32$	$32 < Da \leqslant 64$		
(a) 0.0006/12 frontwards (b) 0.0008/12 upwards	(a) 0.0012/20 frontwards (b) 0.0016/20 upwards	Dial gauge and test mandrel	Clauses 5.412.1 and 5.422.3. [1] For lathes such as $Da > 32$, the measuring length might be increased up to 20.
0.0006	0.0008	Dial gauge	Clauses 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, the readings observed should be divided by cos α, α being the semi cone angle of the taper. The value of force F to be applied should be specified by the manufacturer.
(a) 0.0006/4 frontwards (b) 0.0008/4 upwards	(a) 0.0008/4 frontwards (b) 0.0012/4 upwards	Dial gauge	Clause 5.422.3. After the tailstock sleeve has been sufficiently extended, it should be locked as under normal working conditions.
(a) 0.0012/12 frontwards (b) 0.0008/12 upwards	(a) 0.0020/20 frontwards (b) 0.0020/20 upwards	Dial gauge and test mandrel	Clause 5.422.3. The tailstock sleeve should be locked as under normal working conditions. [1] For lathes such as $Da > 32$, the measuring length might be increased up to 20.
0.0016	0.0024	Dial gauge and test mandrel	Clause 5.422.3. Touch the top generatrix of the mandrel. Readings should be taken at the extremities of the test mandrel with the tailstock and tailstock sleeve locked, as under normal working conditions.
Tailstock centre higher than headstock centre			