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Test conditions for surface grinding machines with horizontal grinding wheel spindle and reciprocating table — Testing of accuracy

Conditions d'essais des machines à rectifier les surfaces planes, à broche porte-meule à axe horizontal — Contrôle de la précision

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Descriptors : machine tools, grinding machines (tools), tests, precision, verifying, test conditions.

Test conditions for surface grinding machines with horizontal grinding wheel spindle and reciprocating table — Testing of accuracy

1 SCOPE AND FIELD OF APPLICATION

This International Standard describes, with reference to ISO/R 230, *Machine tool test code,* both geometrical and practical tests on general purpose and normal accuracy surface grinding machines with reciprocating table and horizontal grinding wheel spindle, and the corresponding permissible deviations which apply.

It is not applicable to surface grinding machines with fixed or rotating tables or to machines having longitudinal traverse of the wheelhead.[1)]

This International Standard 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 machine characteristics (speeds, feeds, etc.) which should generally be checked before testing accuracy.

2 PRELIMINARY REMARKS

2.1 In this International Standard, all the dimensions are expressed in millimetres and in inches.

2.2 To apply this International Standard, reference should be made to ISO/R 230, 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.

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 described 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 these tests are to be clearly stated when ordering a machine.

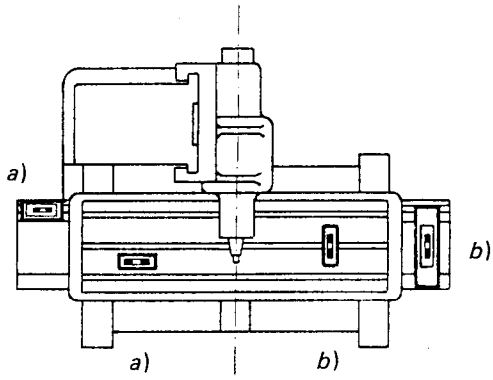
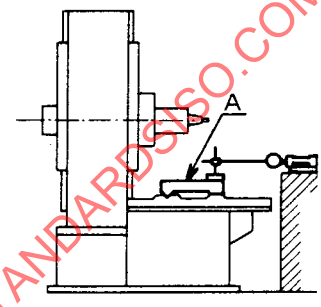
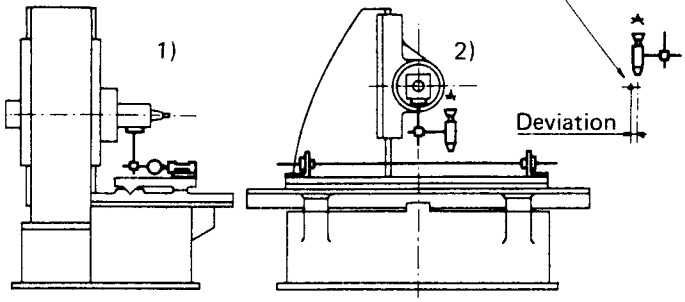
2.5 Practical tests should be made with finishing cuts.

2.6 When the tolerance is established for a measuring range different from that given in this International Standard (see clause 2.311 in ISO/R 230), it should be taken into consideration that the minimum value of tolerance is 0,001 mm (0.000 04 in) for geometrical tests and practical tests.

1) For reasons of simplicity, the diagrams in this International Standard illustrate only one type of machine.

3 TEST CONDITIONS AND PERMISSIBLE DEVIATIONS

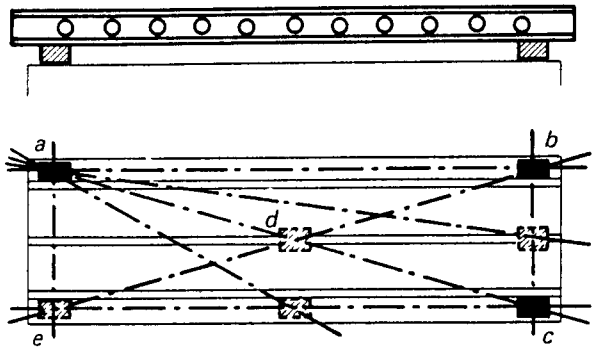
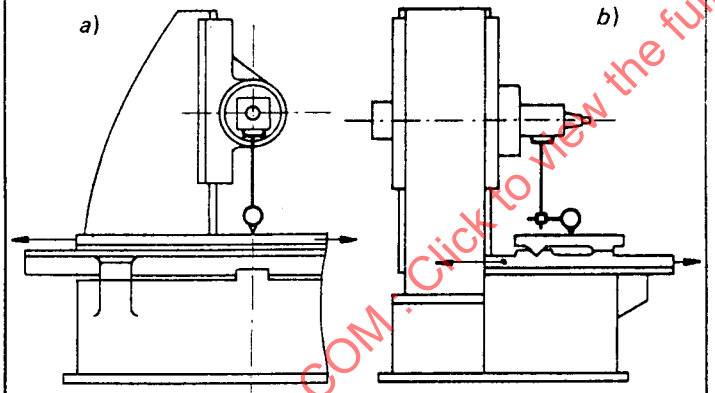
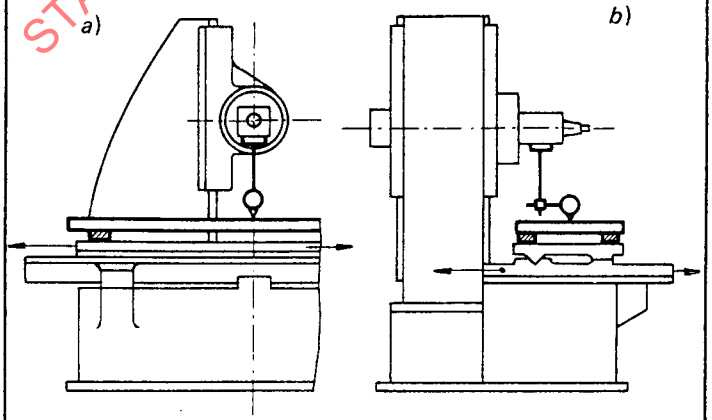
3.1 Geometrical tests

No.	Diagram	Object	
G 1		Verification of levelling of slideways : *a)* longitudinal verification : Straightness of slideways in the vertical plane.	*a)* 0,0 For eac crease in Maximu deviatior
		b) transverse verification : Slideways should be in the same plane.	*b)* Variatio
G 2		Verification of straightness of slideways in a horizontal plane.	0,02 For each 1 in length, ac Maximum viation : Local toleral over any r of 300
	Alternatives 	(These alternatives are for small machines where the table is not to be dismantled.) Verification of the straightness of the longitudinal movement of the table.	0,01 u For each 10 in length, adc Maximum viation : 0

2-3 a)

Object	Permissible deviation		Measuring instrume
	mm	in	
Verification of levelling of slideways : *a*) longitudinal verification : Straightness of slideways in the vertical plane.	*a*) 0,02 up to 1000 For each 1000 mm increase in length, add 0,015 Maximum permissible deviation : 0,05	*a*) 0.0008 up to 40 For each 40 in increase in length, add 0.0006 Maximum permissible deviation : 0.002	Precision levels, op or other methods
b) transverse verification : Slideways should be in the same plane.	*b*) Variation of level : 0,02/1000	*b*) Variation of level : 0.0008/40	
Verification of straightness of slideways in a horizontal plane.	0,02 up to 1000 For each 1000 mm increase in length, add 0,02 Maximum permissible deviation : 0,05 Local tolerance : 0,01 over any measuring length of 300	0.0008 up to 40 For each 40 in increase in length, add 0.0008 Maximum permissible deviation : 0.002 Local tolerance : 0.0004 over any measuring length of 12	Straightedge, supp and dial gauge or wire and microscope
(These alternatives are for small machines where the table is not to be dismantled.) Verification of the straightness of the longitudinal movement of the table.	0,01 up to 1000 For each 1000 mm increase in length, add 0,01 Maximum permissible deviation : 0,025	0.0004 up to 40 For each 40 in increase in length, add 0.0004 Maximum permissible deviation : 0.001	

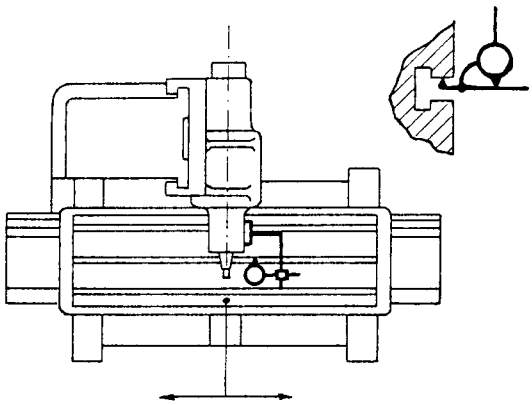
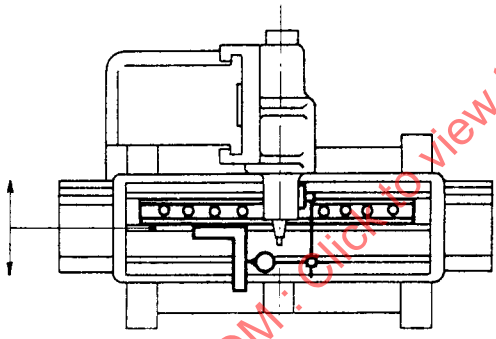
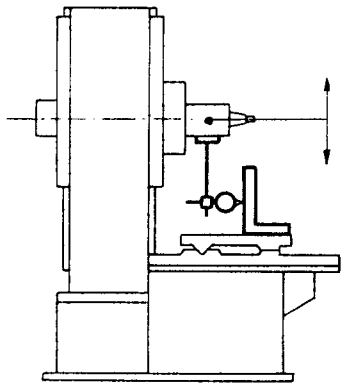
Permissible deviation		Measuring instruments	Observations and references to the test code ISO/R 230
mm	in		
0,02 up to 1000 each 1000 mm increase in length, add 0,015 ximum permissible iation : 0,05	*a*) 0.0008 up to 40 For each 40 in increase in length, add 0.0006 Maximum permissible deviation : 0.002	Precision levels, optical or other methods	*a*) Clauses 3.11, 3.21, 5.212.21 and 5.212.22 Measurements should be made at a number of positions equally spaced along the length of the slideways. For machines standing on three support points or having a table travel less than 1 500 mm (60 in) the table need not be removed. In this case the level should be placed successively on the exposed portions of the slideways and on the table. The table should be in its central position.
riation of level : 0,02/1000	*b*) Variation of level : 0.0008/40		*b*) Clause 5.412.7 A level should be placed transversely on the slideways, and measurements should be taken at a number of positions equally spaced along the length of the slideway. The variation of level measured at any position should not exceed the permissible deviation.
0,02 up to 1000 ch 1000 mm increase th, add 0,02 um permissible de- : 0,05 olerance : 0,01 ny measuring length	0.0008 up to 40 For each 40 in increase in length, add 0.0008 Maximum permissible deviation : 0.002 Local tolerance : 0.0004 over any measuring length of 12	Straightedge, support and dial gauge or taut wire and microscope	Clause 5.232.1 The dial gauge should be fixed on a support A of a suitable form such that it can slide in the slideways with the stylus touching a straightedge laid parallel to the slideways.
,01 up to 1000 ch 1000 mm increase h, add 0,01 m permissible de- : 0,025	0.0004 up to 40 For each 40 in increase in length, add 0.0004 Maximum permissible deviation : 0.001		Clauses 5.232.1 or 5.212.3 – 5.232.2 In alternative 1) the dial gauge support should be placed on a fixed part of the machine, the stylus touching a straightedge laid parallel to the general direction of the longitudinal movement of the table.

No.	Diagram	Object	
G 3		Verification of flatness of the table surface.	
G 4		Verification of parallelism of the table surface : *a*) to its longitudinal movement; *b*) to its transverse movement or to the transverse movement of the wheelhead.	
	Alternative 		

4-5a)

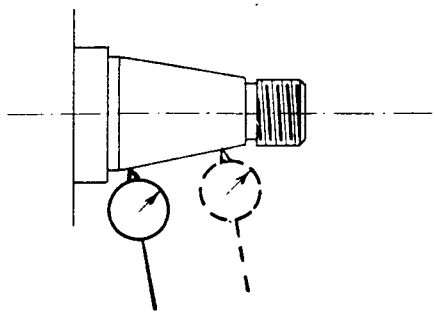
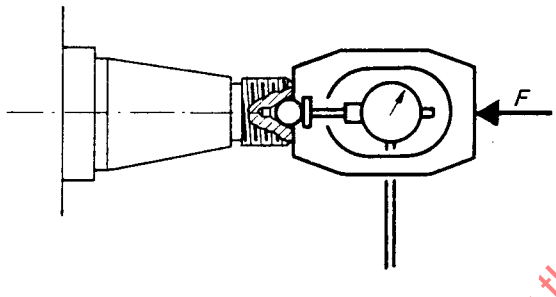
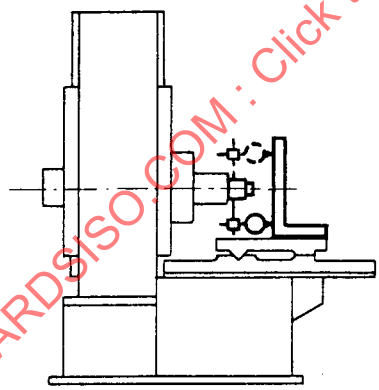
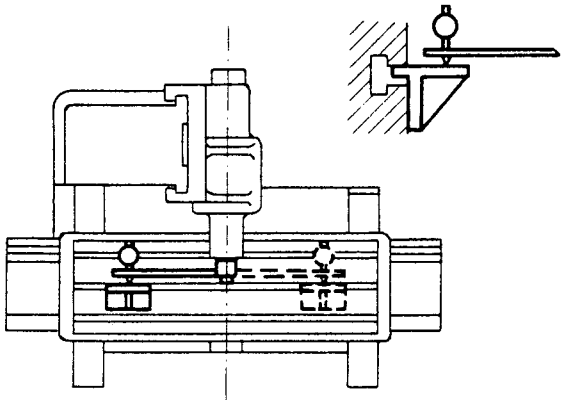
Object	Permissible deviation		Measuring instrumer
	mm	in	
Verification of flatness of the table surface.	0,01 up to 1000 For each 1000 mm increase in length, add 0,01 Maximum permissible deviation : 0,04 Local tolerance : 0,005 over any measuring length of 300	0.0004 up to 40 For each 40 in increase in length, add 0.0004 Maximum permissible deviation : 0.0016 Local tolerance : 0.0002 over any measuring length of 12	Straightedge and gauges or precision le
Verification of parallelism of the table surface : *a*) to its longitudinal movement; *b*) to its transverse movement or to the transverse movement of the wheelhead.	*a*) 0,015 up to 1000 For each 1000 mm increase in length, add 0,01 Maximum permissible deviation : 0,05 Local tolerance : 0,008 over any measuring length of 300 *b*) 0,01 up to 1000	*a*) 0.0006 up to 40 For each 40 in increase in length, add 0.0004 Maximum permissible deviation : 0.002 Local tolerance : 0.0003 over any measuring length of 12 *b*) 0.0004 up to 40	Dial gauge
	a) 0,01 up to 1000 For each 1000 mm increase in length, add 0,005 Maximum permissible deviation : 0,035 *b*) 0,01 up to 1000	*a*) 0.000 4 up to 40 For each 40 in increase in length, add 0.0002 Maximum permissible deviation : 0.0014 *b*) 0.0004 up to 40	Dial gauge and pre sion straightedge

Permissible deviation		Measuring instruments	Observations and references to the test code ISO/R 230
mm	in		
01 up to 1000 n 1000 mm increase , add 0,01 m permissible de- 0,04 lerance : 0,005 y measuring length	0.0004 up to 40 For each 40 in increase in length, add 0.0004 Maximum permissible deviation : 0.0016 Local tolerance : 0.0002 over any measuring length of 12	Straightedge and slip gauges or precision level	Clauses 5.322 and 5.323 The table should be positioned at the centre of travel. The table should not be locked.
0,015 up to 1000 each 1000 mm in- e in length, add 0,01 mum permissible de- on : 0,05 tolerance : 0,008 any measuring length 0 0,01 up to 1000	*a)* 0.0006 up to 40 For each 40 in increase in length, add 0.0004 Maximum permissible deviation : 0.002 Local tolerance : 0.0003 over any measuring length of 12 *b)* 0.0004 up to 40	Dial gauge	Clause 5.422.21 Checking by direct contact with the table. If the spindle can be locked, the dial gauge may be mounted on it. If the spindle cannot be locked, the dial gauge should be placed on a fixed part of the machine. The stylus to be placed approximately in the wheel spindle axis.
0,01 up to 1000 each 1000 mm in- e in length, add 0,005 mum permissible de- n : 0,035 0,01 up to 1000	*a)* 0.000 4 up to 40 For each 40 in increase in length, add 0.0002 Maximum permissible deviation : 0.0014 *b)* 0.0004 up to 40	Dial gauge and precision straightedge	Checking with a straightedge. It is unnecessary to follow the test code ISO/R 230. The checking should be made on a straightedge laid parallel to the table surface and placed in the direction of the movement concerned.

No.	Diagram	Object
G 5		Verification of parallelism of the median or reference tee slot to the longitudinal movement of the table.
G 6		Verification of squareness of the longitudinal movement of the table to its transverse movement or to the wheelhead movement.
G 7		Verification of squareness and straightness of the vertical movement of the wheelhead of the table surface in a transverse vertical plane.

Object	Permissible deviation		Measuring instrum
	mm	in	
Verification of parallelism of the median or reference tee slot to the longitudinal movement of the table.	0,015 up to 1000 For each 1000 mm increase in length, add 0,01 Maximum permissible deviation : 0,05 Local tolerance : 0,008 over any measuring length of 300	0.0006 up to 40 For each 40 in increase in length, add 0.0004 Maximum permissible deviation : 0.002 Local tolerance : 0.0003 over any measuring length of 12	Dial gauge
Verification of squareness of the longitudinal movement of the table to its transverse movement or to the wheelhead movement.	0,03/300	0.0012/12	Straightedge, sc and dial gauge
Verification of squareness and straightness of the vertical movement of the wheelhead of the table surface in a transverse vertical plane.	0,04/300	0.0016/12	Dial gauge and sc

Permissible deviation		Measuring instruments	Observations and references to the test code ISO/R 230
mm	in		
0,015 up to 1000 ach 1000 mm increase th, add 0,01 um permissible de- : 0,05 olerance : 0,008 ny measuring length	0.0006 up to 40 For each 40 in increase in length, add 0.0004 Maximum permissible deviation : 0.002 Local tolerance : 0.0003 over any measuring length of 12	Dial gauge	Clauses 5.422.1 and 5.422.21 If the spindle can be locked, the dial gauge may be mounted on it. If the spindle cannot be locked, the dial gauge should be placed on a fixed part of the machine.
0,03/300	0.0012/12	Straightedge, square and dial gauge	Clause 5.522.4 *a*) Place the straightedge parallel to the longitudinal movement of the table and then place the table in its central position. *b*) Place the square in contact with the straightedge. *c*) Check the transverse movement of the table or the wheelhead.
0,04/300	0.0016/12	Dial gauge and square	Clause 5.522.2 Clamp the wheelhead if possible when taking measurements. If the spindle can be locked, the dial gauge can be mounted on it. If the spindle cannot be locked, the dial gauge should be placed on a fixed part of the wheelhead.

No.	Diagram	Object
G 8		Measurement of run-out of the wheel spindle nose.
G 9		Measurement of periodical axial slip of the wheel spindle.
G 10		Verification of parallelism of the axis of the wheel spindle to the table surface.
G 11		Verification of squareness of the axis of the wheel spindle to the median or reference tee slot of the table.

Object	Permissible deviation		Measuring instrume
	mm	in	
Measurement of run-out of the wheel spindle nose.	0,01	0.0004	Dial gauge
Measurement of periodical axial slip of the wheel spindle.	0,01	0.0004	Dial gauge
Verification of parallelism of the axis of the wheel spindle to the table surface.	0,025/300	0.001/12	Dial gauge and sq
Verification of squareness of the axis of the wheel spindle to the median or reference tee slot of the table.	0,015/300*	0.0006/12*	Dial gauge and sq

8-9 b)

Permissible deviation		Measuring instruments	Observations and references to the test code ISO/R 230
mm	in		
0,01	0.0004	Dial gauge	Clauses 5.612.1 and 5.612.2 The stylus of the dial gauge should be set normal to the surface which is to be checked. Checking should be carried out at each extremity of the taper. This is not stated in the test code ISO/R 230.
0,01	0.0004	Dial gauge	Clauses 5.622.1 and 5.622.2 A force *F*, specified by the manufacturer of the machine, should be exerted co-axially with the spindle. The line of action of the stylus of the dial gauge should be co-axial with the spindle.
0,025/300	0.001/12	Dial gauge and square	Clauses 5.512.1 and 5.512.42 Table in central position. Wheelhead clamped when taking measurements.
0,015/300*	0.0006/12*	Dial gauge and square	Clauses 5.512.1 and 5.512.42 Table in central position. Wheelhead clamped when taking measurements. * Distance between the two points touched.