International Standard ISO 2407

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Acceptance conditions for internal cylindrical grinding machines with horizontal spindle — Testing of accuracy

Conditions de réception des machines à rectifier les surfaces de révolution intérieures, à broche horizontale — Contrôle de la précision

Second edition — 1984-11-01

UDC 621.924.57-187

Ref. No. ISO 2407-1984 (E)

Descriptors : machine tools, grinding machines (tools), tests, testing conditions, dimensional measurements, accuracy.

Price based on 13 pages

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. Every 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.

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 2407 was prepared by Technical Committee ISO/TC 39, *Machine tools*.

ISO 2407 was first published in 1973. This second edition cancels and replaces the first, of which it constitutes a minor technical revision.

Printed in Switzerland

Acceptance conditions for internal cylindrical grinding machines with horizontal spindle — Testing of accuracy

1 SCOPE AND FIELD OF APPLICATION

This International Standard describes, with reference to ISO/R 230, both geometrical and practical tests on general purpose and normal accuracy internal cylindrical grinding machines with horizontal spindle, whether fitted with a surfacing wheel slide or not, and gives the corresponding permissible deviations.

Complementary geometrical tests and a practical test for machines with a surfacing wheel slide are given in the annex.

It deals only with the verification of accuracy of the machine. It does not apply to testing the running of the machine (vibrations, abnormal noises, stick-slip motion of components, etc.), or to its 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 carried out in any order.

2.4 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 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 shall be made with finishing cuts and not with roughing cuts which are liable to generate appreciable cutting forces.

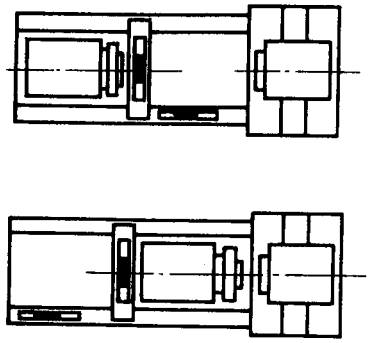
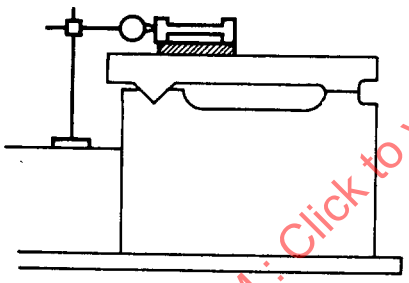
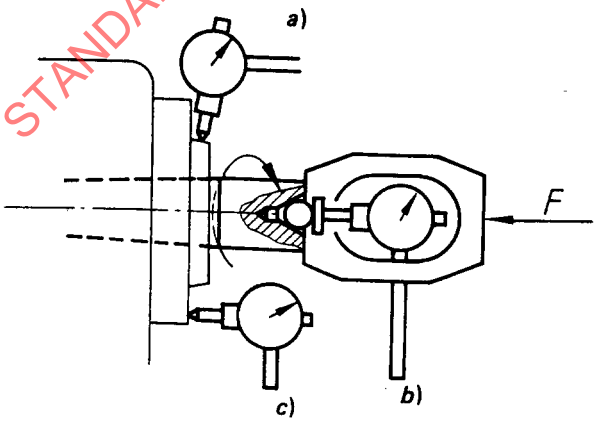
2.6 When the tolerance is established for a measuring range different from that indicated in this International Standard (see 2.311 in ISO/R 230) it should be taken into consideration that the *minimum value of tolerances is* 0,001 mm (0.000 04 in).

3 REFERENCE

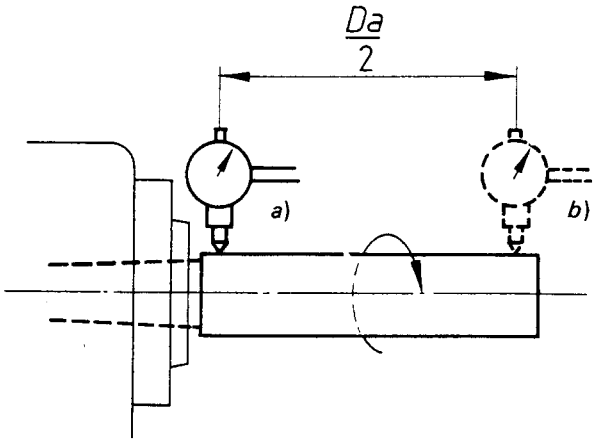
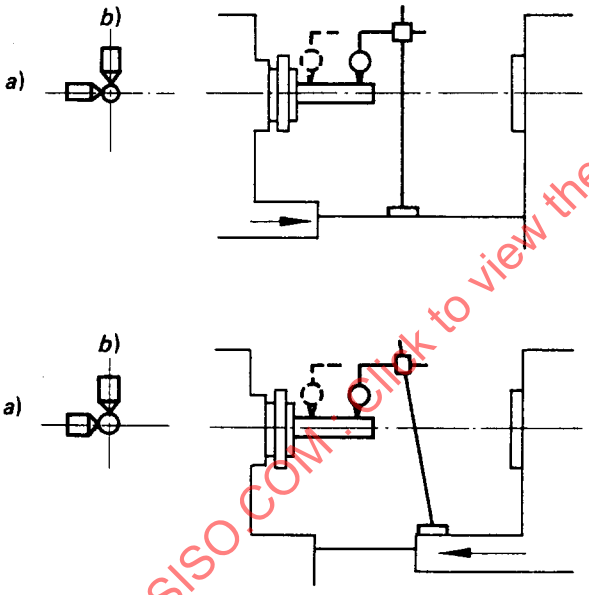
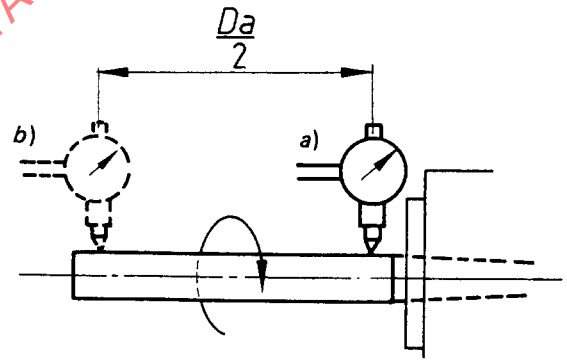
ISO/R 230, *Machine tool test code.*

4 ACCEPTANCE CONDITIONS AND PERMISSIBLE DEVIATIONS

4.1 Geometrical tests

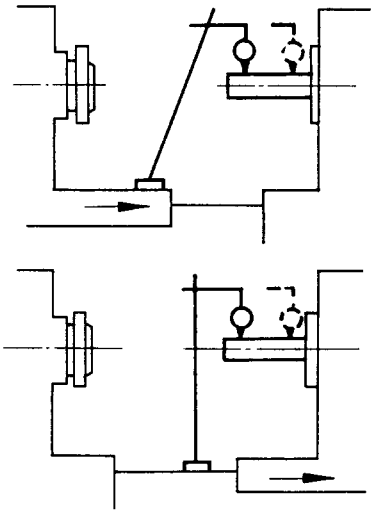
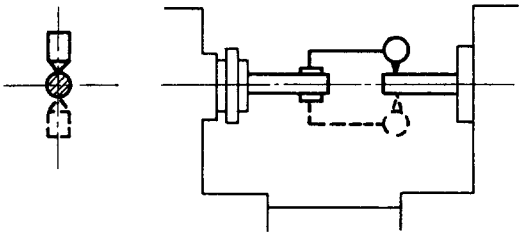
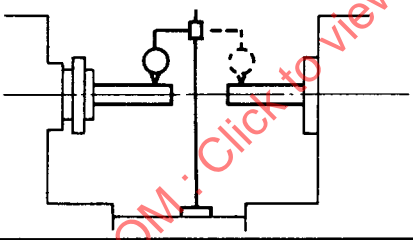
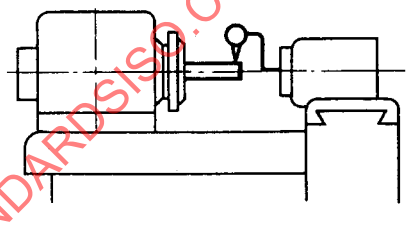
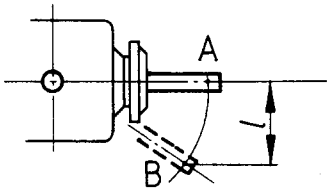
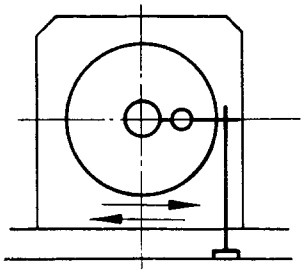
No.	Diagram	Object	
G0		Levelling of the machine.	
G1		**A – TABLE** Checking of straightness of the table movement in the horizontal plane.	for a
G2		**B – WORKHEAD** *a)* Measurement of run-out of the external register diameter of the spindle; *b)* Measurement of periodic axial slip of the work spindle: *c)* Measurement of camming of the register face of the spindle (including periodic axial slip).	*a)* *b)* *c)*

Permissible deviation		Measuring instruments	Observations and references to the test code ISO/R 230
mm	in		
In the case of internal cylindrical grinding machines, no part is to be dismantled (especially in the case of slideways mounted on roller elements). It will be satisfactory to check the levelling with the aid of levels set longitudinally and transversely on the machine according to the manufacturer's specifications.			
0,008 for a 300 mm travel	0.0003 for a 12 in travel	Straightedge and dial gauge	Clause 5.232.1 The dial gauge support shall 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.
a) 0,005	*a*) 0.0002	Dial gauge	*a*) Clause 5.612.2 In the case of a tapered spindle nose the stylus of the dial gauge shall be set normal to the surface to be checked.
b) 0,005	*b*) 0.0002		*b*) and *c*) Clauses 5.62, 5.621.2, 5.622.1, 5.622.2 and 5.632 For the dial gauge position, see Figures 59 to 64 and 67, clauses 5.62, 5.622 and 5.632.
c) 0,01	*c*) 0.0004		The value of force *F* to be applied for the tests *a*), *b*) and *c*) shall be specified by the manufacturer.

No.	Diagram	Object	
G3		Measurement of run-out of the taper or of the internal centring register of the spindle : *a)* at the outlet of the housing; *b)* at a distance from the outlet equal to $\frac{Da^{*}}{2}$ [100 mm (4 in) minimum and 300 mm (12 in) maximum].	*a)* *b)*
G4		Checking of parallelism of the workhead spindle axis to the table movement (in the case of a moving workhead) or to the longitudinal movement of the grinding wheel spindle (in the case of a moving wheelhead) : *a)* in a horizontal plane; *b)* in a vertical plane.	*a)* f o *b)* f o (Test m upward
G5		**C – GRINDING SPINDLE** Measurement of run-out of the grinding wheel spindle (wheel mounting diameter) : *a)* at the outlet of the housing; *b)* at a distance equal to $\frac{Da^{*}}{2}$ [100 mm (4 in) minimum and 200 mm (8 in) maximum]	*a)* *b)* for of

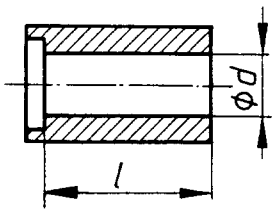
* *Da* = Maximum diameter admissible for workpiece.

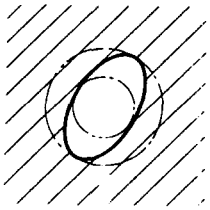
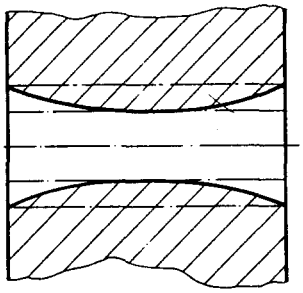
Permissible deviation		Measuring instruments	Observations and references to the test code ISO/R 230
mm	in		
a) 0,005 *b*) 0,015 for a measuring length of 300	*a*) 0.0002 *b*) 0.0006 for a measuring length of 12	Test mandrel according to the type of spindle nose and dial gauge	Clause 5.612.3 In the case of an internal taper, the test will be made with the aid of a mandrel. In the case of a cylindrical centring register, the test will be made with the aid of the dial gauge and without using a test mandrel. In this case, the value of *a*) will be taken as the permissible deviation.
a) 0,01 for a measuring length of 300 *b*) 0,025 for a measuring length of 300 (Test mandrel end directed upwards)	*a*) 0.0004 for a measuring length of 12 *b*) 0.001 for a measuring length of 12 (Test mandrel end directed upwards)	Test mandrel and dial gauge	Clauses 5.412.1 and 5.422.3
a) 0,01 *b*) 0,02 for a measuring length of 200	*a*) 0.0004 *b*) 0.0008 for a measuring length of 8	Test mandrel according to the type of spindle nose and dial gauge	Clause 5.612.3 In the case of an internal taper, the test will be made with the aid of a mandrel. In the case of a cylindrical centring register, the test will be made with the aid of the dial gauge and without using a test mandrel. In this case, the value of *a*) will be taken as the permissible deviation.

No.	Diagram	Object	
G6		Checking of parallelism of the grinding wheel spindle axis to the table movement in a vertical plane **OR** Checking of parallelism of the grinding wheel spindle axis to the longitudinal movement of the wheelhead in a vertical plane.	for a r of 30((Test ma upwards
G7	 **Alternative** 	Measurement of difference in height between the axis of workhead spindle and the axis of wheelhead spindle.	
G8	 	**SWIVELLING WORKHEAD** Checking of parallelism of the mounting face of the swivelling workhead to the cross traverse of the wheelhead.	
G9		Measurement of repeatability of the finish approach of the wheel slide (or the work slide)	

Permissible deviation		Measuring instruments	Observations and references to the test code ISO/R 230
mm	in		
0,03 for a measuring length of 300 Test mandrel end directed ıpwards)	0.0012 for a measuring length of 12 (Test mandrel end directed upwards)	Test mandrel and dial gauge	Clauses 5.412.1 and 5.422.3
0,025	0.001	Dial gauge and special rest	Clause 5.442 The test shall be carried out in the vertical plane after having obtained alignment in the horizontal plane. **Alternative** Clause 5.432.1 The test can be carried out with the dial gauge support set directly on the table.
0,01 for $l = 100$	0.0004 for $l = 4$	Test mandrel and dial gauge	Clause 5.412.1 A reading shall be made when the workhead is locked in position A. Swivel the workhead towards its external position B. Move the cross slide so as to obtain the reading B.
0,002	0.00008	Dial gauge	Carry out six consecutive tests for the wheel slide positioning (or work slide positioning), the movement being obtained by a quick approach followed by a slow approach.

4.2 Practical test

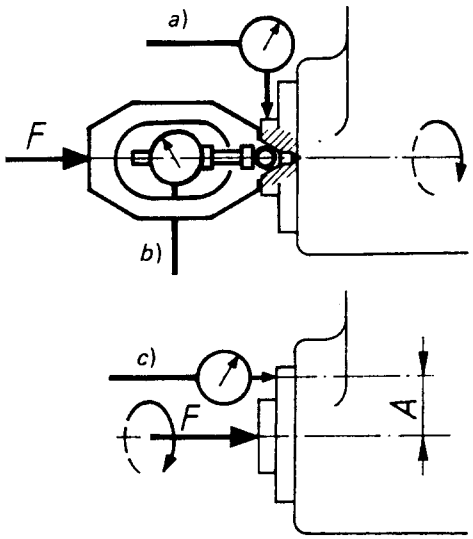
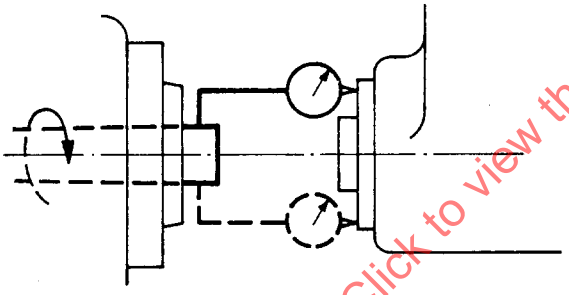
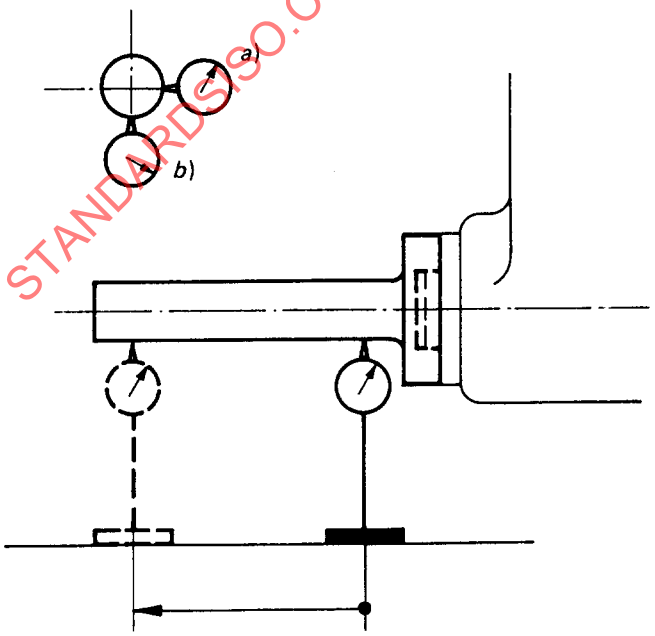
No.	Diagram	Nature of test	Cutting conditions
P1	 Dimensions in millimetres D = Maximum admissible diameter for grinding / d / l D ≤ 40 / 15 / 25 40 < D ≤ 80 / 30 / 50 80 < D ≤ 150 / 60 / 100 D > 150 / 100 / 150 Dimensions in inches D = Maximum admissible diameter for grinding / d / l D ≤ 1.6 / 0.6 / 1 1.6 < D ≤ 3.2 / 1.2 / 2 3.2 < D ≤ 6 / 2.4 / 4 D > 6 / 4 / 6 Material: steel	Grinding of the bore of a test piece mounted on a plate.	Grinding along the whole length l (without arbor support)

ng ions	Checks to be applied	Permissible deviation mm	Permissible deviation in	Measuring instruments	Observations and references to the test code ISO/R 230
ing the le h / out sup-	*a*) Circularity (roundness) (deviation for circularity = difference between the maximum diameter and the minimum diameter of a section). 	*a*) 0,005	*a*) 0.0002	Bore gauge	Clauses 3.1, 3.22, 4.1 and 4.2 Tests for circularity should be made at several positions of the test piece and the greatest value of the deviation obtained. The measurements for consistency of diameter shall be carried out in a single axial plane. NOTE — Any tapes should be such that the major diameter is near the workhead.
	b) Consistency of diameter : Variation of diameter measured at both ends and in the middle of the test piece. 	*b*) for l = 25 : 0,005 for l = 50 : 0,005 for l = 100 : 0,010 for l = 150 : 0,015	*b*) for l = 1 : 0.0002 for l = 2 : 0.0002 for l = 4 : 0.0004 for l = 6 : 0.0006		

ANNEX

COMPLEMENTARY GEOMETRICAL TESTS AND PRACTICAL TEST
(IN THE CASE OF A MACHINE HAVING A SURFACING WHEEL SLIDE)

A.1 GEOMETRICAL TESTS

No.	Diagram	Object	
AG 1		*a*) Measurement of run-out of the surfacing wheel spindle (wheel mounting diameter); *b*) Measurement of periodic axial slip of the surfacing wheel spindle; *c*) Measurement of camming of the face of the spindle nose (including periodic axial slip)	*a*) *b*) *c*)
AG 2		Checking of squareness of the flange face of the surfacing wheel spindle to the workhead spindle axis.	
AG 3		**Moving workhead** Checking of parallelism of the surfacing wheelhead spindle axis to the longitudinal table movement : *a*) in a horizontal plane; *b*) in a vertical plane. **Moving wheelhead** Checking of parallelism of the surfacing wheelhead spindle axis to the longitudinal movement of the wheelhead : *a*) in a horizontal plane; *b*) in a vertical plane.	*a*) *b*)