INTERNATIONAL STANDARD 1701

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Test conditions for milling machines with table of variable height, with horizontal or vertical spindle — Testing of the accuracy

Conditions d'essais des machines à fraiser à table de hauteur variable, à broche horizontale ou verticale — Contrôle de la précision

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up 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.

Prior to 1972, the results of the work of the Technical Committees were published as ISO Recommendations; these documents are now in the process of being transformed into International Standards. As part of this process, Technical Committee ISO/TC 39 has reviewed ISO Recommendation R 1701 and found it suitable for transformation. International Standard ISO 1701 therefore replaces ISO Recommendation R 1701-1970, to which it is technically identical.

ISO Recommendation R 1701 was approved by the Member Bodies of the following countries :

Australia	Greece	Romania
Belgium	Hungary	South Africa, Rep. of
Brazil	India	Spain
Chile	Iran	Sweden
Czechoslovakia	Israel	Switzerland
Egypt, Arab Rep. of	Italy	Thailand
Finland	Korea, Rep. of	Turkey
France	Netherlands	United Kingdom
Germany	New Zealand	

The Member Body of the following country expressed disapproval of the Recommendation on technical grounds :

Japan

The Member Body of the following country disapproved the transformation of ISO/R 1701 into an International Standard :

United Kingdom

Printed in Switzerland

Test conditions for milling machines with table of variable height, with horizontal or vertical spindle — Testing of the accuracy

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies, with reference to ISO/R 230, *Machine tool test code*, both geometrical and practical tests on milling machines with table of variable height and with horizontal or vertical spindle, and gives the permissible deviations corresponding to general purpose and normal accuracy machines.

It deals only with the verification of accuracy of the machine and does not apply to the testing of the running (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 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.

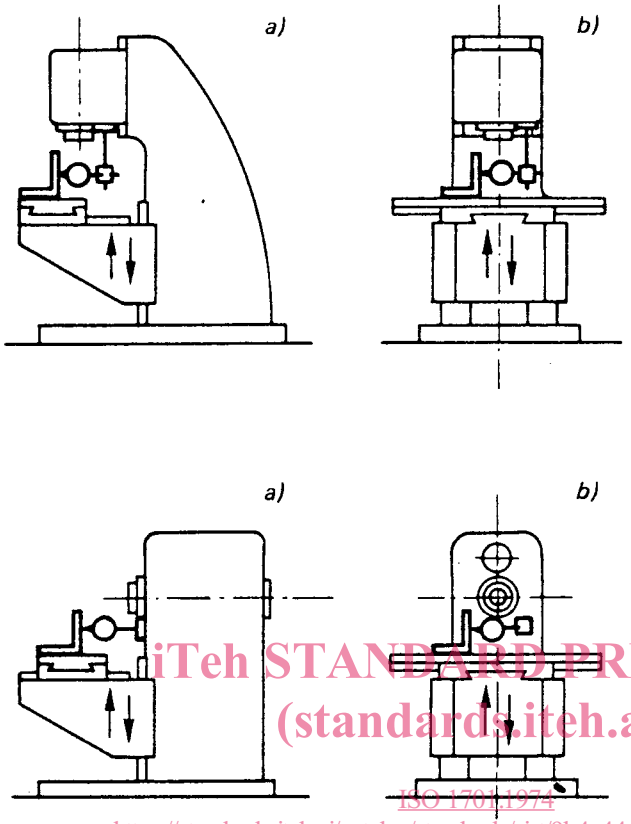
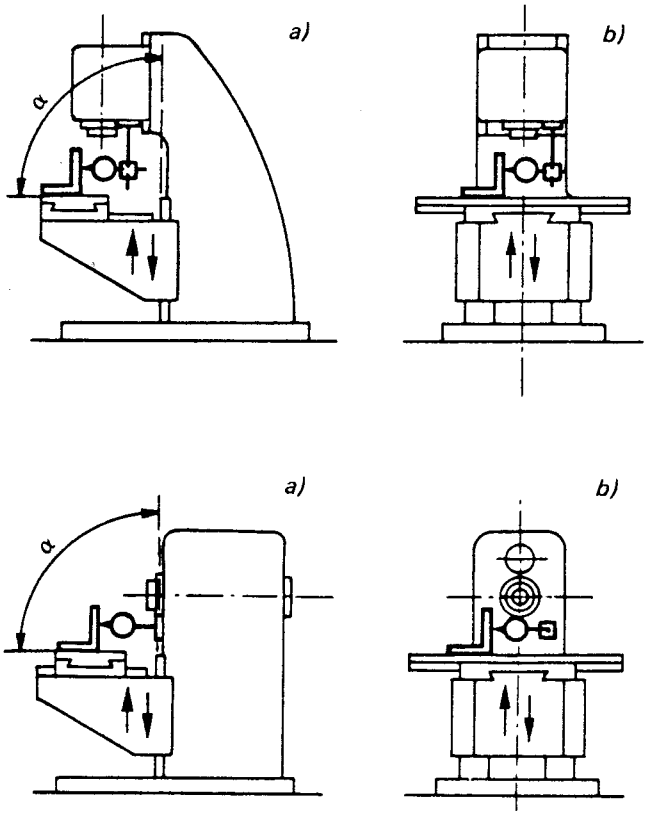
2.4 When inspecting a machine, it is not always necessary to carry out all the tests described in this International Standard. It is up to the user to choose, in agreement with the manufacturer, those relating to the properties which are of interest to him, but these tests are to be clearly stated when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

2.5 Practical tests shall be made with finishing cuts — for instance : depth = 0,1 mm (0.004 in), feed per tooth = 0,1 mm (0.004 in) — 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 given in this International Standard (see sub-clause 2.311 in ISO/R 230), it should be taken into consideration that the minimum value of tolerance is 0,01 mm (0.000 4 in).

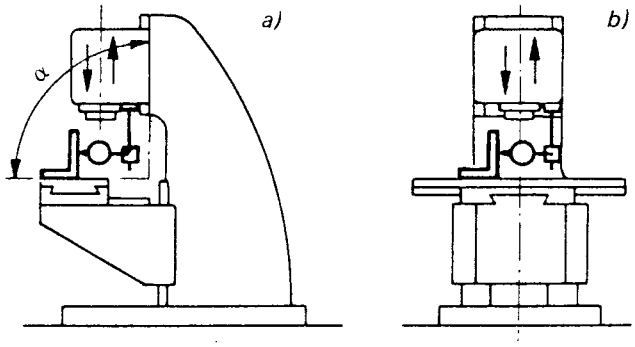
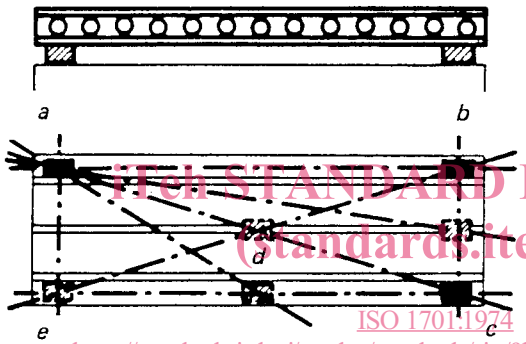
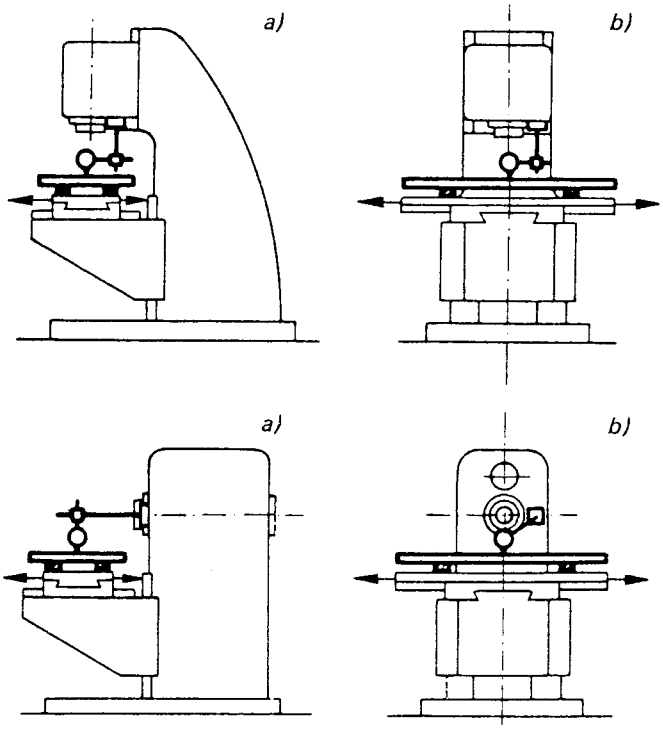
3 TEST CONDITIONS AND PERMISSIBLE DEVIATIONS

3.1 Geometrical tests

No.	Diagram	Object
G 1		Checking of straightness of the vertical movement of the knee : *a*) in the vertical plane of symmetry of the machine; *b*) in the plane perpendicular to the vertical plane of symmetry of the machine.
G 2		Checking of squareness of the table surface to the column ways for knee (in three positions : in the middle and near the extremities of the travel) : *a*) in the vertical plane of symmetry of the machine; *b*) in the plane perpendicular to the vertical plane of symmetry of the machine.

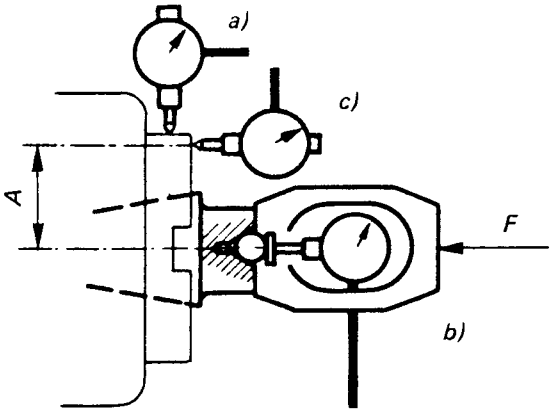
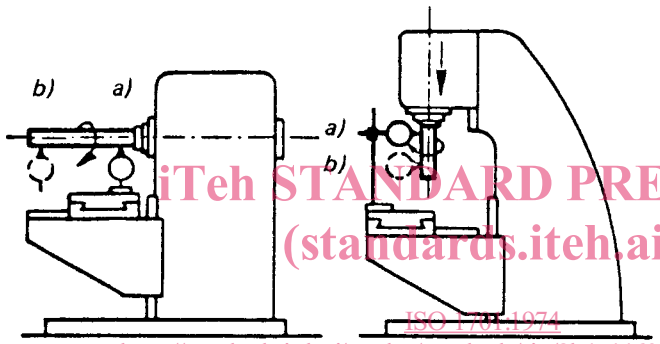
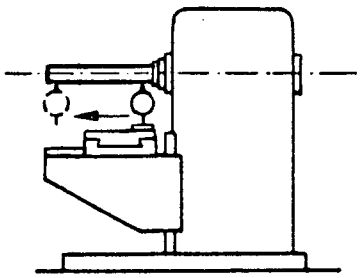
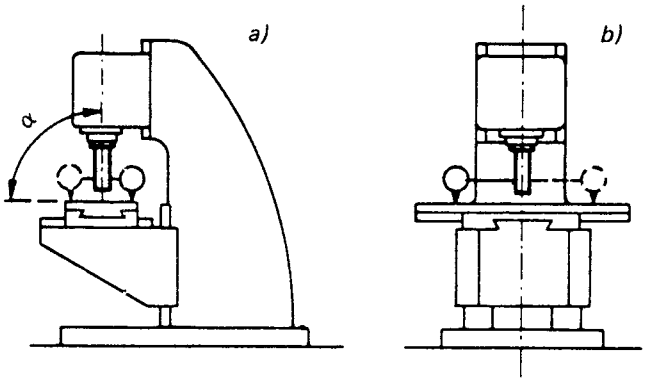
	Permissible deviation		Measuring instruments	Obse and references to th
	mm	in		
of the vertical of symmetry of ndicular to the mmetry of the	a) 0,025 for a measuring length of 300 b) 0,025 for a measuring length of 300	a) 0.001 for a measuring length of 12 b) 0.001 for a measuring length of 12	Dial gauge and square	Claus It is unnecessary t ISO/R 230. Instea the vertical arm of Table in central p slide locked, knee r If the spindle ca gauge may be m spindle cannot be shall be placed o machine.
of the table ays for knee (in middle and near vel) : of symmetry of ndicular to the mmetry of the	*a)* 0,025/300 with $\alpha \leqslant 90^\circ$ *b)* 0,025/300	*a)* 0.001/12 with $\alpha \leqslant 90^\circ$ *b)* 0.001/12	Dial gauge and square	Claus Table in central p slide locked. Knee locked wher If the spindle ca gauge may be m spindle cannot be shall be placed o machine.

Permissible deviation		Measuring instruments	Observations and references to the test code ISO/R 230
mm	in		
0,025 for a measuring length of 300 0,025 for a measuring length of 300	a) 0.001 for a measuring length of 12 b) 0.001 for a measuring length of 12	Dial gauge and square	Clause 5.232.1 It is unnecessary to follow the test code ISO/R 230. Instead of a straightedge, use the vertical arm of a square. Table in central position, table and cross slide locked, knee not locked. If the spindle can be locked, the dial gauge may be mounted on it. If the spindle cannot be locked, the dial gauge shall be placed on a fixed part of the machine.
0,025/300 with $\alpha \leqslant 90^\circ$ 0,025/300	*a*) 0.001/12 with $\alpha \leqslant 90^\circ$ *b*) 0.001/12	Dial gauge and square	Clause 5.522.2 Table in central position, table and cross slide locked. Knee locked when taking measurements. If the spindle can be locked, the dial gauge may be mounted on it. If the spindle cannot be locked, the dial gauge shall be placed on a fixed part of the machine.

No.	Diagram	Object
G 3		Checking of squareness of the table surface to the vertical movement of the spindle head slide : *a*) in the vertical plane of symmetry of the machine; *b*) in the plane perpendicular to the vertical plane of symmetry of the machine.
G 4		Checking of flatness of the table surface.
G 5		Checking of parallelism of the table surface to its movement : *a*) transversely; *b*) longitudinally.

	Permissible deviation		Measuring instruments	Observ and references to the
	mm	in		
of the table vement of the f symmetry of dicular to the ametry of the	*a*) 0,025/300 with $\alpha \leqslant 90°$ *b*) 0,025/300	*a*) 0.001/12 with $\alpha \leqslant 90°$ *b*) 0.001/12	Dial gauge and square	Clause Table in central po locked. Spindle head slide measurements. If the spindle can gauge may be mo spindle cannot be shall be placed on of the machine.
e table surface.	0,04 up to 1000 For each 1000 mm increase in table length, add 0,005 Maximum permissible deviation : 0,05 Local tolerance : 0,02 for any measuring length of 300	0.0016 up to 40 For each 40 in increase in table length, add 0.005 Maximum permissible deviation : 0.002 Local tolerance : 0.0008 for any measuring length of 12	Precision level or straightedge and slip gauges	Clauses 5.3 Table and cross sli table not locked, locked. NOTE – The alphab diagram correspond to of ISO/R 230.
of the table	a) 0,025 for any measuring length of 300 b) 0,025 for any measuring length of 300 Maximum permissible deviation : 0,05	a) 0.001 for any measuring length of 12 b) 0.001 for any measuring length of 12 Maximum permissible deviation : 0.002	Straightedge and dial gauge	Clause The stylus of the d approximately at th the tool. The measurement straightedge laid p surface. If the table length is (64 in), carry out successive movemer Knee locked. If the spindle can gauge may be mo spindle cannot be shall be placed on machine. *a*) Table and spindl *b*) Cross slide and locked.

Permissible deviation		Measuring instruments	Observations and references to the test code ISO/R 230
mm	in		
0,025/300 with $\alpha \leqslant 90^\circ$ 0,025/300	*a*) 0.001/12 with $\alpha \leqslant 90^\circ$ *b*) 0.001/12	Dial gauge and square	Clause 5.522.2 Table in central position, knee and table locked. Spindle head slide locked when taking measurements. If the spindle can be locked, the dial gauge may be mounted on it. If the spindle cannot be locked, the dial gauge shall be placed on the spindle head slide of the machine.
0,04 up to 1000 ch 1000 mm increase in ength, add 0,005 um permissible devi- 0,05 olerance : 0,02 ny measuring length	0.0016 up to 40 For each 40 in increase in table length, add 0.005 Maximum permissible deviation : 0.002 Local tolerance : 0.0008 for any measuring length of 12	Precision level or straightedge and slip gauges	Clauses 5.322 and 5.323 Table and cross slide in central position, table not locked, knee and cross slide locked. NOTE – The alphabetical references on the diagram correspond to those used in figure 19 of ISO/R 230.
0,025 for any measuring ength of 300 0,025 for any measuring ength of 300 num permissible devi- 0,05	a) 0.001 for any measuring length of 12 b) 0.001 for any measuring length of 12 Maximum permissible deviation : 0.002	Straightedge and dial gauge	Clause 5.422.21 The stylus of the dial gauge to be placed approximately at the working position of the tool. The measurement may be made on a straightedge laid parallel to the table surface. If the table length is greater than 1600 mm (64 in), carry out the inspection by successive movements of the straightedge. Knee locked. If the spindle can be locked, the dial gauge may be mounted on it. If the spindle cannot be locked, the dial gauge shall be placed on a fixed part of the machine. *a*) Table and spindle head slide locked; *b*) Cross slide and spindle head slide locked.

No.	Diagram	Object
G 6		*a*) Measurement of run-out of the external centring surface on the spindle nose (for machines having this feature). *b*) Measurement of periodic axial slip. *c*) Measurement of camming of the face of the spindle nose (including periodic axial slip).
G 7		Measurement of run-out of the internal taper of the spindle : *a*) at the mouth of taper; *b*) at a distance of 300 mm (12 in) from the spindle nose.
G 8		Checking of parallelism of the spindle axis to the table surface (for horizontal spindle machines only).
G 9		Checking of squareness of the spindle axis to the table surface (for vertical spindle machines only) : *a*) in the vertical plane of symmetry of the machine; *b*) in the plane perpendicular to the vertical plane of symmetry of the machine.