INTERNATIONAL STANDARD ISO 3655/I

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

Test conditions for vertical turning and boring lathes with one or two columns — Testing of the accuracy — Part I : Lathes with a single fixed or movable table

Conditions d'essai des tours verticaux à un ou deux montants — Contrôle de la précision — Partie I : Tours à un seul plateau fixe ou déplaçable

First edition — 1976-08-01

UDC 621.914.4

Ref. No. ISO 3655/I-1976 (E)

Descriptors : machine tools, lathes, vertical boring and turning lathes, tests, testing conditions, dimensional control, accuracy, precision.

Price based on 11 pages

FOREWORD

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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.

International Standard ISO 3655/I was drawn up by Technical Committee ISO/TC 39, *Machine tools,* and was circulated to the Member Bodies in March 1975.

It has been approved by the Member Bodies of the following countries :

Australia	India	Spain
Austria	Ireland	Sweden
Belgium	Italy	Switzerland
Bulgaria	Japan	Turkey
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Germany	Romania	U.S.S.R.
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The Member Bodies of the following countries expressed disapproval of the document on technical grounds :

Czechoslovakia
U.S.A.

Printed in Switzerland

Test conditions for vertical turning and boring lathes with one or two columns — Testing of the accuracy — Part I : Lathes with a single fixed or movable table

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies, with reference to ISO/R 230, both geometrical and practical tests on general purpose and normal accuracy vertical turning and boring lathes with one or two columns and with a single fixed or movable table and gives corresponding permissible deviations which apply.

It deals only with the verification of accuracy of the machine. It does not apply to 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 REFERENCES

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

ISO 3655/0, *Test conditions for vertical turning and boring lathes with one or two columns — Testing of the accuracy — Part 0 : General introduction.*

ISO/R 1101, *Tolerances of form and of position — Part 1 : Generalities, symbols, indications on drawings.*

3 PRELIMINARY REMARKS

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

3.2 To apply this International Standard, reference should be made to ISO/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.

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 relating to the properties which are of interest to him, but these tests are to be clearly stated when ordering a machine.

3.5 The practical tests shall be made with finishing cuts 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 given in this International Standard (see 2.311 in ISO/R 230) it should be taken into consideration that the minimum value of tolerance is 0,002 5 mm (0.000 1 in) for geometrical and practical tests.

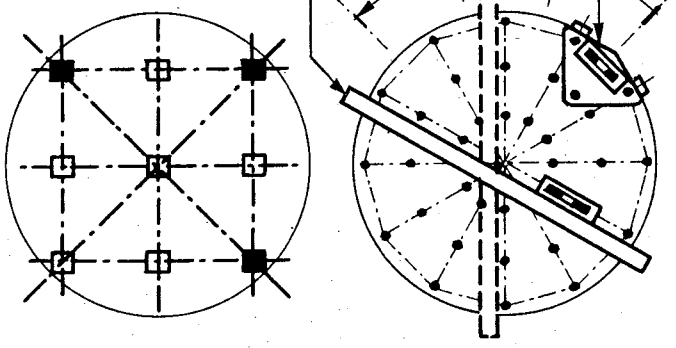
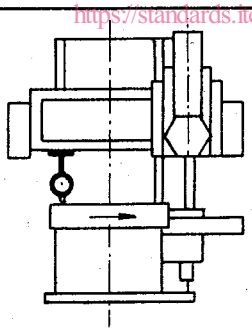
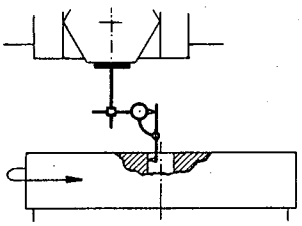
3.7 For table or column movable type, tests shall be carried out setting the column as near as possible to the axis of rotation of the table.

4 DIAGRAMS

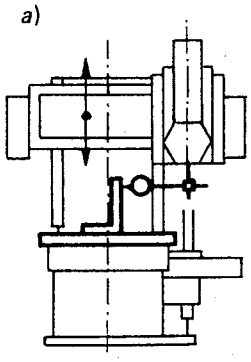
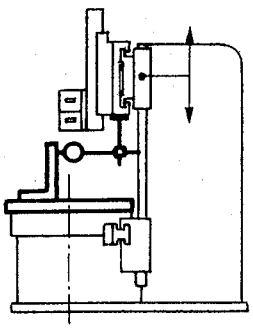
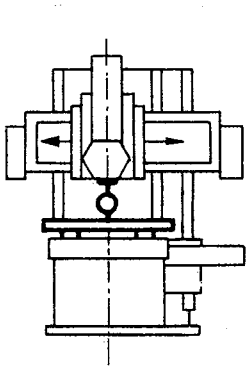
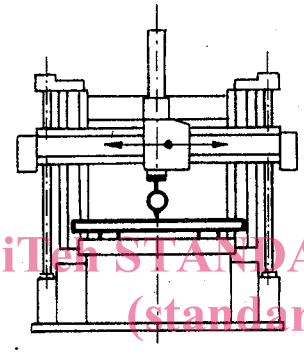
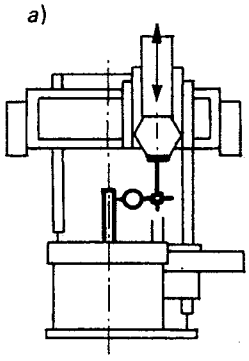
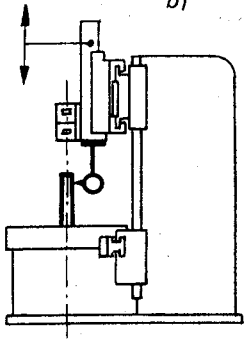
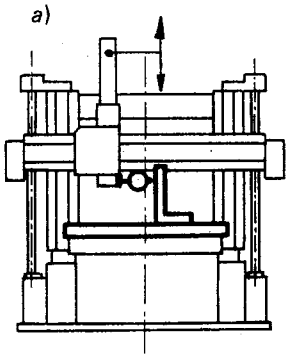
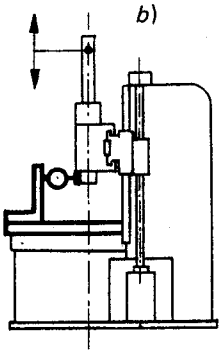
For reasons of simplicity, diagrams in this International Standard illustrate only typical designs of machines.

5 TEST CONDITIONS AND PERMISSIBLE DEVIATIONS

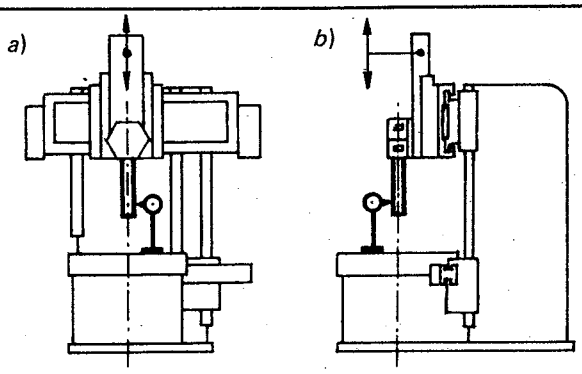
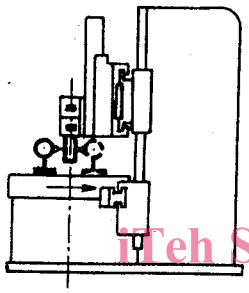
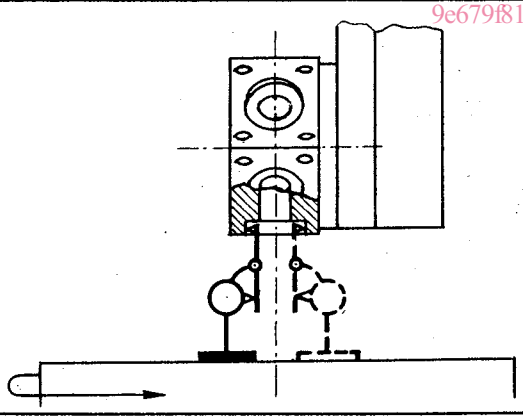
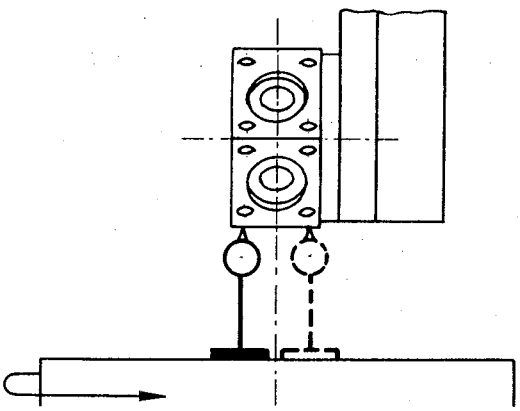
5.1 Geometrical tests

No.	Diagram	Object	mm
G 1	 Alternative	**A – TABLE** *a*) Levelling This operation is recommended only when checking is carried out with the aid of a precision level, i.e. when the alternative test described in the Observations column is used. *b*) Verification of flatness of the table surface.	*a*) 0,06/1000 *b*) 0,03 for 1000 For each 1000 mm tolerance : 0,01 0,01 ove 300
G 2		Measurement of camming of the table surface when rotating.	0,02 / 1000 For each 1000 mm tolerance : 0,01
G 3		Measurement of run-out of the table bore; or Measurement of run-out of the external cylindrical surface of the table (in the case of a table not having a central bore).	0,02 / 1000 For each 1000 mm tolerance : 0,01

Permissible deviation			Measuring instruments	Observations and references to the test code ISO/R 230
mm		in		
0,06/1000	*a*)	0.0025/40	Straightedge and gauge blocks or precision levels	Clauses 5.322 and 5.323 **Alternative test** (Checking with the aid of level) 1) Circular-diametrical checking The level shall be placed on a support A provided with isostatic bearings (three bearing points on the table surface and two on the table periphery) — The support shall be moved at positions equally spaced along the table periphery. 2) Radial-diametrical checking The level shall be placed on the table and along a diametrical direction with the aid of a straightedge B. The level shall be moved at positions equally spaced along the straightedge. The procedure shall be repeated moving the straightedge according to the successive positions occupied by the support A. Subject to agreement between manufacturer and user, it is permissible to carry out in G 1b) diametrical checking only.
0,03	*b*)	0.0012		
for any measuring diameter of :				
1000		40		
(flat to concave)				
each 1000 mm (40 in) increase in diameter add to the rance :				
0,01		0.0004		
Local tolerance :				
0,01		0.0004		
over any measuring length of :				
300		12		
0,02		0.0008	Dial gauge	Clause 5.632 The dial gauge shall be placed on a fixed part of the machine and shall be placed as near as possible to the table periphery and approximately 180° from the position occupied by the tool when the table was machined. Rail, railhead and slide locked in position.
for a table diameter of :				
1000		40		
each 1000 mm (40 in) increase in diameter add to the rance :				
0,01		0.0004		
0,02		0.0008	Dial gauge	Clauses 5.611.4 and 5.612.2 The dial gauge shall be placed approximately 180° from the position occupied by the tool when the table was machined. Rail, railhead and slide locked in position. The dial gauge shall also be placed on a fixed part of the machine.
for a table diameter of :				
1000		40		
each 1000 mm (40 in) increase in table diameter add to the rance :				
0,01		0.0004		

No.	Diagram	Object	mm
G 4	a)  b) 	**B – RAIL AND RAILHEAD** Checking of squareness of the vertical slideways of the column to the table surface : *a*) in a plane parallel to the rail; *b*) in a plane perdendicular to the plane parallel to the rail.	*a*) 0,04/1000 *b*) 0,06/1000
G 5	 	Checking of parallelism of the movement of the railhead or railheads to the table surface.	*a*) wi 0,03 fo *b*) 0,02
G 6	a)  b) 	Checking of parallelism of the toolhead slide or slides movement to the axis of rotation of the table : *a*) in a plane parallel to the rail; *b*) in a plane perpendicular to the plane parallel to the rail. or Checking of squareness of the toolhead slide or slides movement to the table surface : *a*) in a plane parallel to the rail; *b*) in a plane perpendicular to the plane parallel to the rail.	*a*) 0,01 *b*) 0,015 300
	a)  b) 		

Permissible deviation			Measuring instruments	Observations and references to the test code ISO/R 230
mm		in		
0,04/1000 0,06/1000	*a)* *b)*	0.0016/40 0.0025/40	Straightedge, square and dial gauge	Clause 5.522.2 Railhead and slide locked in position. The rail shall be locked on its column or columns before each measurement. The checking shall be carried out moving the rail successively in the upper position, mid-travel, and in the lower position.
a) without a height correcting device : 0,03		0.0012	Straightedge, gauge blocks and dial gauge	Clause 5.422.22 — Rail and slide locked in position. — Checking shall be made by applying the dial gauge stylus on a straightedge laid parallel to the table surface.
for a 1000 mm (40 in) travel				
b) with a height correcting device : 0,02		0.0008		
for a 1000 mm (40 in) travel				
0,01 0,015	*a)* *b)*	0.0004 0.0006	Test mandrel and dial gauge	Clause 5.422.3 Rail and railhead locked in position.
for a measuring length of : 300		12	Straightedge, square and dial gauge	Clause 5.512.2 Rail and railheads locked in position.

No.	Diagram	Object	mm	
G 7		**C – TURRET** Checking of parallelism of the tool housing axes to the slide movement : *a)* in a plane parallel to the rail; *b)* in a plane perpendicular to the plane parallel to the rail.	*a)* *b)* 300	0,02 0,03
G 8		Checking of coaxiality between the axes of the tool housing and the axis of rotation of the table.		0,025*
G 9		Checking of coaxility between the axes of the centering surfaces of the tool holders and the axis of rotation of the table.		0,025*
G 10		Checking of squareness of the faces of turret with the axis of rotation of the table.		0,02/30

Permissible deviation			Measuring instruments	Observations and references to the test code ISO/R 230
mm		in		
0,02 0,03 for a measuring length of : 300	*a)* *b)*	0.0008 0.0012 12	Test mandrel and dial gauge	Clause 5.422 These operations shall be repeated for each of the tool housings.
0,025*		0.001*	Test mandrel and dial gauge	Clause 5.442 – A mandrel of a 300 mm (12 in) maximum length shall be inserted in one of the tool housings. – A dial gauge shall be fixed on the table; rotate the table and adjust the position of the mandrel until the deviations shown on the dial gauge are at a minimum. – Repeat the operation by placing the dial gauge stylus at several different heights. – Repeat the same operations for each of the tool housings. * The value of permissible deviation is equal to half of the total readings of the dial gauge.
0,025*		0.001*	Dial gauge	Clause 5.442 – A dial gauge shall be fixed on the table and shall touch the inside of the centering housing of the tool holders. – The table shall be rotated. – This same operation shall be repeated for each of the housings of the turret. * The value of permissible deviation is equal to half of the total readings of the dial gauge.
0,02/300		0.0008/12	Dial gauge	Clause 5.512.1 – A dial gauge shall be fixed on the table and shall touch the face of turret located opposite. – The table shall be rotated and dial gauge shall be moved to touch the face of turret on the largest possible diameter. – This same operation shall be repeated for each of the faces of the turret.