# International Standard



3070/3

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION⊕MEXCLYHAPOCHAR OPFAHU3AUUR ПО CTAHCAPTU3AUUN GORGANISATION INTERNATIONALE DE ÑORMALISATION

Acceptance conditions for boring and milling machines Testing of the accuracy -Part 3: Planer type machines with movable column

Cick to view the full standard of the standard Conditions de réception des machines à aléser et à fraiser, à broche horizontale Contrôle de la précision — Partie 3 : Machines à montant mobile et bançs en croix

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Descriptors: boring and milling machines, tests, test conditions, dimensional measurement, accuracy.

#### **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 3070/3 was developed by Technical Committee ISO/TC 39, Machine tools, and was circulated to the member bodies in August 1980.

It has been approved by the member bodies of the following countries:

Australia

India

South Africa, Rep. of

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No member body expressed disapproval of the document. STANDARD

# Acceptance conditions for boring and milling machines — Testing of the accuracy — Part 3: Planer type machines with movable column

#### 1 Scope and field of application

This part of ISO 3070 describes, with reference to ISO/R 230, both geometrical and practical tests on general purpose and normal accuracy boring and milling machines, planer type with movable column, and the corresponding permissible deviations which apply.

This part of ISO 3070 concerns machines which are defined in sub-clause 3.2 and 3.3 of ISO 3070/0.

These machines can be provided with spindle heads of different types corresponding in most cases to figures:

- 4 (spindle head with milling spindle and boring spindle),
- 5 (spindle head with sliding boring spindle and with facing head),
- 6 (spindle head with ram or milling arm),
- of Part 0: "General Introduction" of ISO 3070.

It must moreover be made clear that this part of ISO 3070 concerns machines which have a movement of the table along the X-axis and possibly, a movement of rotation along a vertical axis parallel to the Y-axis.

This part of ISO 3070 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 (such as speeds, feeds, etc.) which should generally be checked before testing accuracy.

#### 2 Preliminary remarks

- 2.1 In this part of ISO 3070, deviations and ranges are expressed in millimetres and in inches.
- **2.2** To apply this part of ISO 3070, reference should be made to ISO/R 230, especially for installation of the machine before testing, warming up of spindles or other moving parts, descrip-

tion 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.
- When inspecting a machine, it is not always possible or necessary to carry out all the tests given in this part of ISO 3070. 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 establishing the tolerance for a measuring range different from that given in this part of ISO 3070 (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 both geometrical and practical tests.

#### **NOTES**

- 1 For rotary table machines, reference should be made to the complementary tests indicated in addendum 1 to ISO 3070/1.
- $2\,$  For machines which have a steady, reference should be made to the test G 30.

#### 3 References

ISO/R 230, Machine tool test code.

ISO 841, Numerical control of machines — Axis and motion nomenclature.

ISO 1101, Technical drawings — Tolerances of form and of position — Part 1: Generalities, symbols, indications on drawings. 1)

<sup>1)</sup> At present at the stage of draft. (Revision of ISO/R 1101/1-1969.)

ISO 3070/0, Test conditions for boring and milling machines with horizontal spindle — Testing of the accuracy — Part 0: General introduction.

ISO 3070/1, Test conditions for boring and milling machines with horizontal spindle — Testing of the accuracy — Part 1: Table type machines.

Addendum 1 to ISO 3070/1, Complementary geometrical tests and practical test to be specified in the case of rotary table machines.

ISO 3070/2, Test conditions for boring and milling machines with horizontal spindle — Testing of the accuracy — Part 2: Floor type machines.

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## 4 Test conditions and permissible deviations

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### 4.1 Geometrical tests

No.	Diagram	Object	
		A — TABLE AND COLUMN BEDS	
		Verification of levelling of slideways :	
		a) Checking of bed lengthwise :	a)
		straightness of slideways in the vertical plane	
		1) table bed;	Fo to
	1) 2)	2) column bed.	
	21	,	
G 1		2) column bed.	
	b) a)	(c)	
	b)	Office	
	a) a) click to lien the full p	b) Checking of bed crosswise :	<u></u>
	a) a)	- slideways should be in the same	"
	ien	plane	
	*0	1) table bed;	,
	cilicit	2) column bed.	
	A4:		
	Deviation		Fo to
7	Wire	Checking of straightness of the slideways in a horizontal plane :	
G 2		1) table bed;	
-	<u>A</u>	2) column bed.	
	Alternative		

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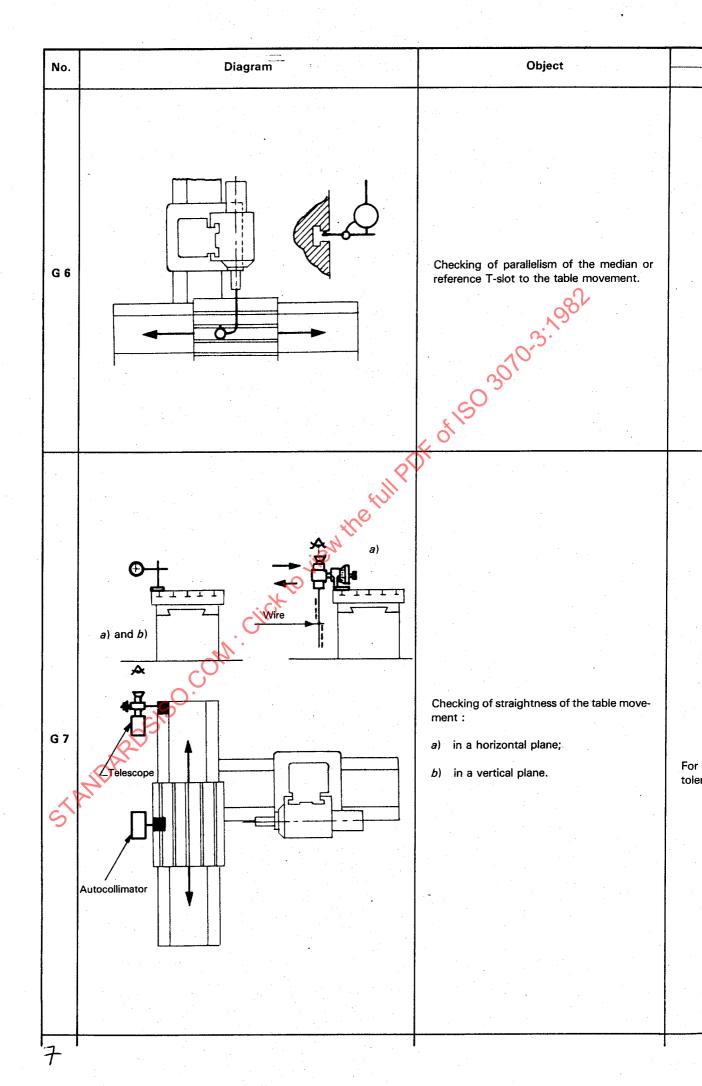
n	Object	Permissible deviation		
		mm	in	
	A — TABLE AND COLUMN BEDS			
	Verification of levelling of slideways :			
	a) Checking of bed lengthwise:	a) 0,02	a) 0.0008	
	<ul> <li>straightness of slideways in the vertical plane</li> </ul>	up to 1000	up to 40	
	1) table bed;	tolerance	se in length, add to the preceding	
2)	2) column bed.	0,01	0.0004	
		Local to	erance :	
		0,006	0.00024	
[ — b)			uring length of	
		Maximum parmi	12    ssible deviation :	
		0,05	0.002	
	b) Checking of bed crosswise :	b) Variation	<del> </del>	
	slideways should be in the same plane	0,02/1000	0.0008/40	
	plane  1) table bed;			
	2) column bed.			
<b></b>	NRDSISO.COM.	0,02	0.0008	
		up to 1000	up to 40	
	DAKE	For each 1000 mm (40 in) increas tolerance	e in length, add to the preceding	
The state of the s	Checking of straightness of the slideways in a horizontal plane :	0,01	0.0004	
	1) table bed;	Local tol	erance:	
A		0,006	0.00024	
	2) column bed.	over any meas	l uring length of	
		300	12	
		Maximum permis	ssible deviation :	
		0,05	0.002	

Permissible deviation		Measuring instruments	Observations and references to the test code ISO/R 230	
mm	in		and references to the test code 150/ N 250	
			a) Clauses 3.11, 3.21, 5.212.21	
0,02	a) 0.0008		or 5.212.22	
up to 1000	up to 40	Precision level, optical or other	Measurements shall be made at a number	
1000 mm (40 in) increas	e in length, add to the preceding	methods	of positions equally spaced along the length of the beds, table and column plac-	
			ed at the ends then at the middle of their	
0,01	0.0004		traverse.	
Local tol	l erance :		(raverse.	
0,006	0.00024		10,0	
			30,	
over any meas			$\mathcal{S}^{O}$	
300	12		A STATE OF THE STA	
Maximum permis	ssible deviation :		*	
0,05	0.002			
Variation	of level :	The second	b) Clause 5.412.7	
0,02/1000	0.0008/40	Precision level and	A level shall be placed transversely and	
	:	support	measurements taken at a number of posi- tions equally spaced along the length of the	
		jie	bed. The variation of level at any position	
		140	shall not exceed the permissible deviation.	
		ici		
		7		
	ON		Clauses 5.212.3 or 5.212.22 or 5.232.1	
0,02	0.0008	Microscope and taut	The microscope or the dial gauge shall be fixed	
	up to 40	wire or other optical methods	on a support A of a suitable form such that it can slide in the slideways and shall sight or	
up to 1000		methods	touch, in the horizontal plane, the taut wire or	
1000 mm (40 in) increas	e in length add to the preceding		a straightedge laid parallel to the slideways.	
0.01	0.0004		The taut wire or the straightedge shall be placed on a fixed part, independent of or in-	
0,01			tegral with the machine and as near as possi-	
Localto	erance :		ble to the slideways to be checked.	
0,006	0.00024		Observations :	
over any measi	I uring length of		The microscope or the dial gauge can be fixed	
300	12		on the column itself if the column bed is short.	
		Dial gauge,	NOTE — Such checking is valid only under such	
Maximum permis		straightedge and sup- port	conditions where the displacement of the moving elements on the beds is sufficient for measurements	
0,05	0.002		to be taken over the whole bed length.	

No.	Diagram	Object	
G 3		B — TABLE Checking of flatness of the table surface.	Fo
	<b>√</b>	<b>.</b> O	
	The full pr		Fo tol
G 4		Checking of parallelism of the table surface to its movement.	
	MDARDS 150.		
5			
G 5		Checking of the straightness of the median or reference T-slot of the table.	

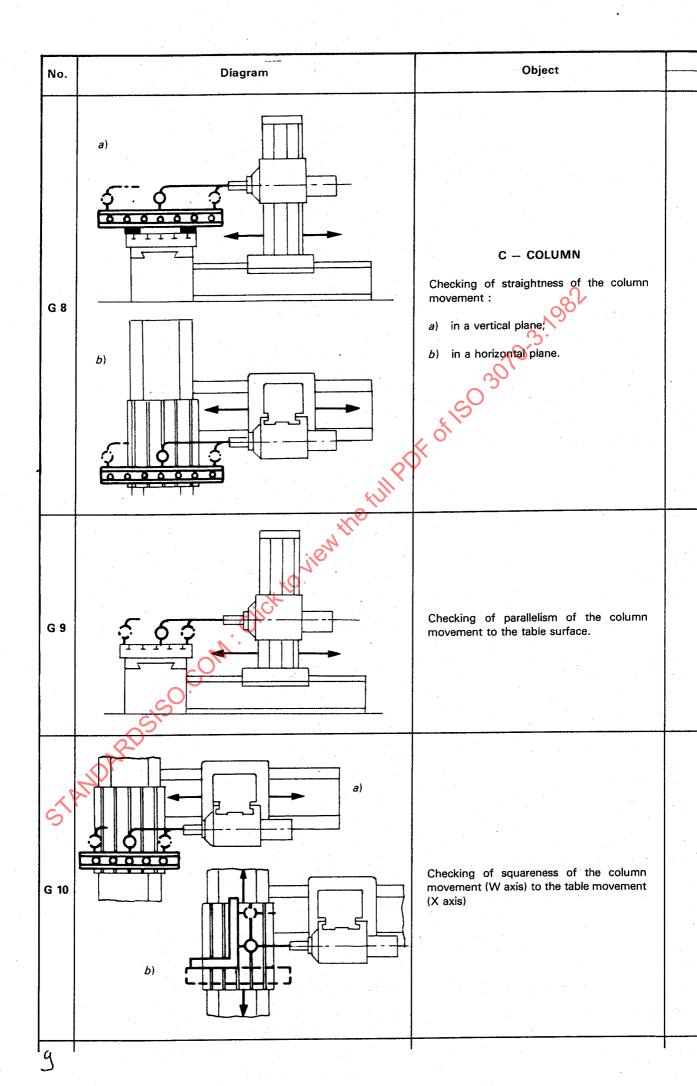
		Parmiesih	le deviation	
anaring prominen	Object	mm in		
		1100		<del></del>
		0,02	0.0008	
		up to 1000	up to 40	
		(flat to	concave)	
X		For each 1000 mm (40 in) increat tolerance :	 se in length, add to the pre 	cedir
	B TABLE	0,02	0.0008	
	Checking of flatness of the table surface.	Local to	l plerance :	
		0,015	0.0006	
		over any meas	suring length of	
		300	12	
			ssible deviation :	
		0,08	0.0032	
		ODK		
		0,04	0.0016	
		up to 1000	up to 40	
	no.	For each 1000 mm (40 in) increat tolerance :		cedin
	rojo <sup>n</sup>	0,01	0.0004	
	Checking of parallelism of the table surface			
·		er en	lerance:	
	W.	0,015	0.0006	-
	O	over any meas	uring length of	
	, co.	300	12	
	to its movement.	Maximum nermi	ssible deviation :	
	2V 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			
	OP.	0,06	0.0024	
\Q			·	
5				
1		0,02	0.0008	
<i>//</i>		for any measu		
	Checking of the straightness of the median			
<b>(</b> // <u>14</u>	or reference T-slot of the table.	1000	40	
<i>Y//</i> <b>37</b>		Maximum permis	ssible deviation :	
		0,03	0.0012	
				· ·
6bis				
NG G				

Permissible	deviation	Measuring instruments	Observations
mm	in	goi willonto	and references to the test code ISO/R 230
0,02	0.0008		
up to 1000	up to 40		
up to 1000	up to 40		
(flat to c	oncave)		
1 1000 mm (40 in) increas :	e in length, add to the preceding		
0,02	0.0008	Precision level or	Clauses 5,322 and 5,323
0,02	0.000	straightedge and	
Local tol	erance :	gauge blocks	Table in its mid-position and locked on its bed.
0,015	0.0006		31030103.1982
aver one mose	uring longth of		
over any measu	ining length of		
300	12		<b>10</b>
   Maximum permis	sible deviation :		30.
0,08	0.0032		
			<u>, 0'</u>
			01 5.000.4 5.400.04
			Clauses 5.232.1 or 5.422.21
0,04	0.0016		The stylus of the dial gauge shall be placed
p to 1000	up to 40	we.	approximately in a vertical plane containing the spindle axis.
		Jien the full	ите эртине аль.
000 mm (40 in) increase	e in length, add to the preceding	ile"	Measurement may be made on a straightedge
		×O	laid parallel to the table surface.
0,01	0.0004	Straightedge, gauge	If the table length is greater than 1600 mm
Local tole	erance:	blocks and dial gauge	(64 in), carry out the inspection by successive movements of the straightedge. If the spindle
			can be locked, the dial gauge may be mounted
0,015	0.0006		on it. If the spindle cannot be locked, the dial
over any measu	ring length of		gauge shall be placed on a fixed part of the machine.
	1250		
300			Case of rotary tables :
Maximum permis	sible deviation		Instead of a single check, four checks shall be
0,06	0.0024		made by rotating the table four times of 90°. Use the greatest of the four deviations
0,00	U.002T		observed as the parallelism deviation
	PI		(ISO 3070/1 — Addendum 1).
<u>6</u>	`		
	0.000		
0,02	0.0008		
for any measur	ring length of		Clauses 5.212, 5.212.1, 5.212.3 or 5.232
1000	40	Straightedge and dial	
1000	<b>₩</b>	gauge, or microscope and taut wire	The straightedge may be set directly on the
Maximum permis	sible deviation :		table.
0,03	0.0012		
3,55			



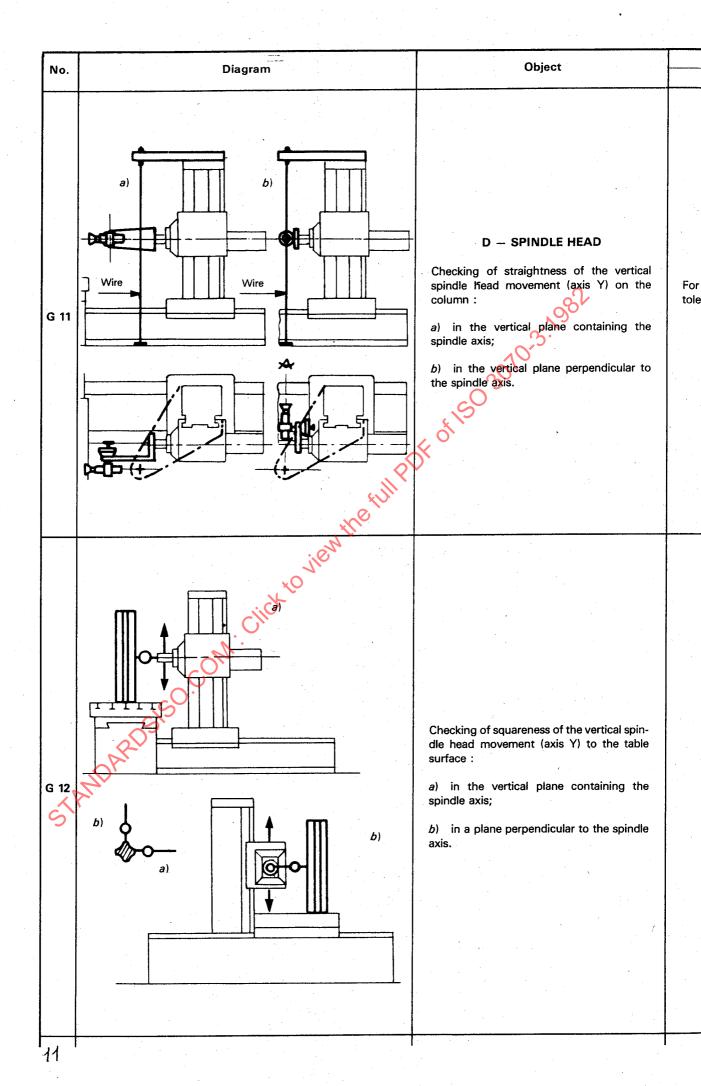
	Object	Permissible deviation		
	Object	mm	in	
•				
		0,03	0.0012	
		over any	length of	
<b>4</b>	Checking of parallelism of the median or reference T-slot to the table movement.	1000	40	
· · · · · · · · · · · · · · · · · · ·		Maximum permi	ssible deviation :	
		0,04	0.0016	
		40	,p.	
, ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' '		100		
		<b>~</b> O <sup>3</sup>		
		415		
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		, 8 <sub>0</sub> ,		
		[1]		
		No.	e e e	
<b>♠</b> a)	4			
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	°OW.			
		For a) a	ind b) :	
1.3	Checking of straightness of the table move- ment:	0,02	0.0008	
	a) in a horizontal plane;	up to 1000	up to 40	
	in a vertical plane.	For each 1000 mm (40 in) increas	e in length, add to the preceding	
11 11	• m. in a vectical plane.		•	
	y in a volucial plants.	tolerance :		
-5	y in a volucial plants.	tolerance : 0,01	0.0004	
-5	y in a volucial plants.			
-5				
-5				
_5 _6				

Permissible	e deviation	Measuring instruments	Observations
mm	in	ivicasumy instruments	and references to the test code ISO/R 230
0,03	0.0012		
0,03	0.0012		Clauses 5.232.1 and 5.422.21
over any	length of		
1000	40	Dial gauge	Column locked on its bed.
1000	<b>.</b>	Dial gauge	If the spindle can be locked, the dial gauge
Maximum permis	ssible deviation :		may be mounted on it; otherwise, it shall be
0,04	0.0016		mounted on a fixed part of the machine
- <b>0,0</b> -	0.0010		4 of 150 3010.3.
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	ON		
   For <i>a</i> ) a	nd <i>h</i> )		
1014,4	<b>.</b>	Optical methods	
0,02	0.0068	(alignment telescope,	
up to 1000	up to 40	autocollimator, laser,	Clauses 5.212.22 or 5.212.3 and 5.232.2
		etc.) and taut wire [for a) only] and level	Cladest Clairies Of Charles Unit Charles
1000 mm (40 in) increas	e in length, add to the preceding	[for b) only]	
:	at.		
0,01	0.0004		
<b>S</b>			
		1	

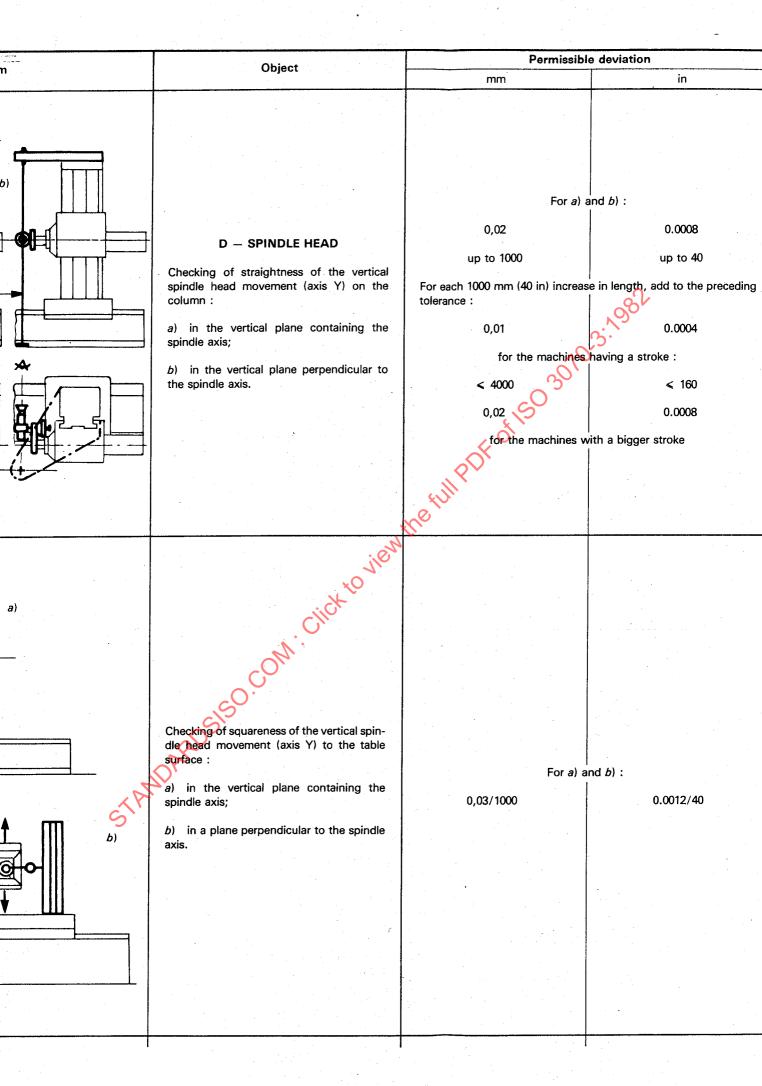


			*		
~~~	Object	Permissible deviation			
	Object	mm	in		
<u> </u>					
		For a) a	and <i>b</i> ):		
	C – COLUMN		0.0008		
	Checking of straightness of the column	0,02			
·	movement:	up to 1000	up to 40		
	a) in a vertical plane;	0,03	0.0012		
•	b) in a horizontal plane.	above 1000	above 40		
		30,			
		.00			
2~5		A STATE OF THE STA			
		₩ °			
		above 1000			
		FUII			
		No.			
	1	0,04	0.0016		
	to lien	up to 1000	up to 40		
		0,06	0.0024		
	Checking of parallelism of the column	above 1000	above 40		
	movement to the table surface				
	ON	Local to	erance:		
		0,015	0.0006		
	inoversent to the table surface.	over 300	over 12		
	22				
a) SA					
5			· · · · · · · · · · · · · · · · · · ·		
<b></b>	Checking of squareness of the column				
	movement (W axis) to the table movement (X axis)	0,03/1000	0.0012/40		
	(^ dxi5)				
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Te					
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	. · · <del>-</del> -		
Permissible deviation		Measuring instruments	Observations
mm	, in	Wicasuting modulinents	and references to the test code ISO/R 230
			·
For all	 and <i>b</i> ) :		Clause 5.232.1
· · · · · · · · · · · · · · · · · · ·			
0,02	0.0008		The straightedge shall be placed on the table and laid parallel to the slideways of the column
up to 1000	up to 40	Dial gauge,	bed (table and spindle head tocked).
	•	straightedge and	
0,03	0.0012	gauge blocks or op- tical methods	For checking a), the straightedge is laid vertically on edge and for test b) horizontally and
above 1000	above 40	1	A \ \
			flat On Control of Con
			cO <sup>-</sup>
•			
			2.0
			OX.
		ILLY	
		to lien the fill	
0,04	0.0016		
up to 1000	up to 40	.07	01 5 400 00
0,06	0.0024	**	Clause 5.422.22
aha 1000	above 40	Dial gauge	Table locked on its bed.
above 1000	above 40	Diai gauge	The dial gauge can touch a straightedge laid
Local to	lerance :		on the table.
0,015	0.0006		
•	0.		
over 300	over 12		
· · ·	ANDARY		
			Clauses 5.522.4 and 5.212.22
	AT		
Service Servic			Spindle head placed in mid-travel and locked.
· · · · · · · · · · · · · · · · · · ·			a) The straightedge shall be set parallel to
	A .	Dial gauge,	the column longitudinal movement and fixed; then the square shall be placed against the
		straightedge and	straightedge.
0,03/1000	0.0012/40	squares or optical	
		methods	<ul> <li>b) The movement of the table shall then be checked.</li> </ul>
			If the spindle can be locked, then 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.
		t en e	



Permissible		Measuring instruments	Observations and references to the test code ISO/R 230
mm	in		and references to the test code 130/ N 230
For <i>a</i> ) and	4 <b>b)</b> ·		Clauses 5.212.3, 5.232.2 or 5.212.22
1			Carry out the test with the column and table
0,02	8000.0		locked, table in mid-position.
up to 1000	up to 40		The taut wire shall be tightened between fixed
1000 mm (40 in) increase i	in length, add to the preceding		parts independent of or integral with the
:	ir length, and to the preceding	Microscope and taut	machine, and as near as possible to the vertical slideways of the column.
0,01	0.0004	wire or optical methods	SILCOVALYS OF THE SOLUTION
		Mictiods	If the spindle can be locked, the microscope or
for the machines ha	aving a stroke :	a dis	the alignment telescope can be mounted on it.
< 4000	<b>&lt;</b> 160		If the spindle cannot be locked, the alignment telescope shall be placed on the spindle head
0,02	0.0008		of the machine. The spindle head shall be
			locked during measurements.
for the machines with	a bigger stroke		
	·	11/10	
		Ng;	
		7/0	
		N. NO	
		ilo,	
	ARDSISO.COM.		
2.4	co.		Clauses 5.522.2 or 5.212.22
	S		Carry out the test with the column and table
	203		locked.
For a) and	INCA	Dial gauge and square	The spindle head shall be locked during
· · ·	4	or optical methods	measurements.
0,03/1000	0.0012/40		If the spindle can be locked, the dial gauge can
9			be mounted on it. If the spindle cannot be
			locked, it shall be placed on the spindle head of the machine.
	•		
-dd lois			
AA IAIL			



		T	T
No.	Diagram	Object	
G 13	b) a)	E — BORING SPINDLE  Measurement of run-out of the internal taper of the boring spindle:  a) at the mouth of taper;  b) at a distance of 300 mm (12 in) from the spindle nose.	a) b) a) b)
G 14	ien in the state of the state o	Measurement of run-out of the boring spindle:  (a) spindle retracted;  (b) spindle extended 300 mm (12 in) (sliding spindle).	a) b) a) b)
G 15	ADARDS P	Measurement of periodic axial slip of the boring spindle (spindle retracted).	
G 16		Checking of squareness of the boring spindle axis to the column ways.	
13			

		Permissible deviation			
n .	Object	mm	in		
	E — BORING SPINDLE	For $D^{1)} < 125$ :	For $D^{(1)} < 5$ :		
	Measurement of run-out of the internal	a) 0,01	a) 0.0004		
	taper of the boring spindle :	<i>b</i> ) 0,02	b) 0.0008		
	a) at the mouth of taper;	For $D^{(1)} > 125$ :	For $D^{(1)} > 5$ :		
	b) at a distance of 300 mm (12 in) from the spindle nose.	a) 0,015	a) 0.0006		
		<i>b</i> ) 0,030	b) 0.0012		
** *		20			
		For $D^{1)} < 125$ :	For $D^{(1)} < 5$ :		
1	Measurement of run-out of the boring spindle:	a) 0,01	a) 0.0004		
	a) spindle retracted;	b) 0,02	b) 0.0008		
	b) spindle extended 300 mm (12 in)	For $D^{(1)} > 125$ :	For $D^{(1)} > 5$ :		
	(sliding spindle).	al 0,015	a) 0.0006		
	4	(b) 0,030	<i>b</i> ) 0.0012		
	- Jie				
	clickie				
		For <i>D</i> <sup>1)</sup> < 125 :	For $D^{(1)} < 5$ :		
	Measurement of periodic axial slip of the	0,01	0.0004		
	boring spindle (spindle retracted).	For $D^{1)} > 125$ :	For $D^{1)} > 5$ :		
		0,015	0.0006		
<b>1</b>	ORK				
K. P.					
Щ					
		0,03/1000 <sup>1)</sup>	0.0012/40 <sup>1)</sup>		
	Checking of squareness of the boring spindle axis to the column ways.	$\alpha$ with $\alpha$			
IJON					

Permissible	e deviation	Measuring instruments	Observations
mm	in		and references to the test code ISO/R 230
$ D^{(1)}  \le 125$ :	For $D^{(1)} \le 5$ :		
0,01	a) 0.0004		Clause 5.612.3
0,02	b) 0.0008	Dial gauge and test mandrel	Carry out measurements with the spindle retracted (sliding spindle).
$D^{1)} > 125$ :	For $D^{(1)} > 5$ :	manaro	1) $D = \text{diameter of boring spindle.}$
0,015	a) 0.0006		1) D = diameter of boring spiridic.
0,030	<i>b</i> ) 0.0012		0
			1981
			VO.2.
$D^{1)} \le 125$ :	For $D^{(1)} < 5$ :		3010
0,01	a) 0.0004		
0,02	<i>b</i> ) 0.0008		Clause 5.612.2
$D^{1)} > 125$ :	For $D^{1)} > 5$ :	Dial gauge	1) $D =$ diameter of boring spindle.
0,015	a) 0.0006	ienthefull	
0,030	b) 0.0012	ine	
		h3;	
	•	7/2	
		ck 10	
			Clauses 5.622.1 and 5.622.2
$D^{(1)} < 125$ :	For $D^{1} < 5$ :		Carry out this test with the spindle retracted
0,01	0.0004	Dial gauge	(sliding spindle).
$D^{1)} > 125$ :	For <i>D</i> <sup>1</sup> > 5:		The existence, value and the direction of application of the force $F$ shall be stated by the
0,015	0:0006		manufacturer.
	NOAK		1) $D=$ diameter of boring spindle.
ć	A STATE OF THE STA		
			Clauses 5.512.1 and 5.512.42
			Column locked in mid-travel on its bed,
,03/1000 <sup>1)</sup>	0.0012/40 <sup>1)</sup>	Diel severe and	spindle-head locked in mid-travel on the column, spindle and possibly ram retracted.
with $\alpha$		Dial gauge and possibly straightedge	For large machines for which sizes have a
			great importance, the measuring reference shall be related to a plane parallel to the column ways.
			Distance between the two points touched.

No.	Diagram	Object
G 17	Alternative  a)  b) O	Checking of parallelism of the boring spindle axis to the column movement :  a) in a vertical plane;  b) in a horizontal plane.
G 18	THE FULL PLANTS OF THE FULL PLAN	Checking of squareness of the boring spindle axis to the table movement.
G 19		Checking of straightness of the boring spindle movement (sliding spindle) (axis Z):  a) in a horizontal plane;  b) in a vertical plane.
S		
G 20		Checking of parallelism of the sliding movement of the boring spindle, in relation to a reference plane parallel to the longitudinal movement of the column (axis W).
5		

La se	Object	Permissib	le deviation
	Coject	mm	in
TI			
	Checking of parallelism of the boring	For a)	and b):
	spindle axis to the column movement :	0,02	0.0008
	a) in a vertical plane;	fau a maaa.	ring longth of
		for a measu	ring length of
	b) in a horizontal plane.	300	12
			2
			VO.
			3.
		2/2	
		603011	
<b>7</b>		٥	
록	Checking of squareness of the boring	0,02/500 6,111PDF	
	spindle axis to the table movement.	0,02/500	0.0008/20
		W.	
		We	
	. 0,4		
	Checking of straightness of the boring spin-		
	dle movement (sliding spindle) (axis Z) :		
a)	a) in a horizontal plane;	a) 0,02	a) 0.0008
	a) il a nonzontal plane,		
$\mathbf{Q}$	and the second second	for a measu	ring length of
<b>b</b> )	$\mathcal{O}$	300	12
D,	b) in a vertical plane.	b) 0,02	<i>b</i> ) 0.0008
	b) In a vertical plane.		
		for a measu	ring length of
	P	300	12
	<b>V</b>	For an extension of the spindle ed	qual to twice the spindle diamete
1 AX		+ 0,015	+ 0.0006
5`		•	vards)
		For an extension of the spindle	
		diameter	
<del>]</del> •	Checking of parallelism of the sliding move-	± 0,02	± 0.0008
δ	ment of the boring spindle, in relation to a reference plane parallel to the longitudinal	For an extension of the spindle	e equal to six times the spino
<b>I</b>	movement of the column (axis W).	diameter :	
		- 0,06	- 0.0024
			wards)
		NOTE — The extension of the spin diameter and cannot exceed	dle is limited to six times the spino
		glameter and cannot exceed 900	36
		300	<b>30</b>

Permissibl	e deviation	Measuring instruments	Observations
mm	in		and references to the test code ISO/R 23
			Clauses 5,412.1 and 5,422.3
For all a	 and <i>b</i> ) :		Ciauses 9.412.1 and 9.422.3
			Spindle head locked in mid-travel, table
0,02	0.0008	Dial gauge and	locked. The measurement shall be carried ou according to the possibilities either touching
for a measur	I ing length of	possibly test mandrel	directly the external part of the boring spindle
tor a moddar			or with the aid of a test mandrel mounted in
300	12		the spindle nose (alternative).
. 1			<b>9</b>
			.00
			ci.
			400
			(°5°
			Clause 5.522.3
	0.000.00	Straightedge and dial	Call and animally bound by the desired by
0,02/500	0.0008/20	gauge	Column and spindle head locked, spindle head in mid-travel. A straightedge laid on the table
			will be set parallel to the table movement.
		The state of the s	
		×6	
		ie	Clause 5.232.1
		×O	
		4	Spindle head locked.
0,02	a) 0.0008 (	ilo.	The straightedge shall be set parallel to the
			axial spindle movement; then touch the func-
for a measuri	ng length of	Straightedge, gauge	tional surface of the straightedge with the stylus of a dial gauge fixed on the spindle nose.
300	12	blocks and dial gauge	Styles of a dial gauge fixed off the opinion from
			Repeat the same operations in the two planes:
0,02	b) 0.0008		horizontal and vertical.
for a measuri	ng length of		In the case of a machine having a ram, it shall
200	<b>2</b>		be maintained locked, in the retracted position.
300	12		position.
nsion of the spindle eq	ual to twice the spindle diameter :		
+ 0,015	+ 0.0006		Clause 5.232.1
(upwa	ards)		Place a straightedge on the machine table and
	equal to four times the spindle		align it, in the vertical containing the spindle.
and opinion			Adjust the etrajahtedae to bring it in a beri
± 0,02	± 0.0008	Straighted as as as	Adjust the straightedge to bring it in a hori- zontal plane parallel to the column movement.
	equal to six times the spindle	Straightedge, gauge blocks and dial gauge	
	adam to an milion and abiliare		Touch the functional surface of the straight
- 0,06	- 0.0024		edge with a dial gauge fixed on the spindle nose.
(down			
			Extend the spindle of the requested length and
ne extension of the spind d cannot exceed	le is limited to six times the spindle		note the dial gauge readings for each of the successive positions.
900	36		

		<b>*</b>	·
No.	Diagram	Object	
G 17	Alternative  b)  compared to the compared to t	Checking of parallelism of the boring spindle axis to the column movement:  a) in a vertical plane; b) in a horizontal plane.	
G 18		Checking of squareness of the boring spindle axis to the table movement.	
G 19		Checking of straightness of the boring spindle movement (sliding spindle) (axis Z):  a) in a horizontal plane;  b) in a vertical plane.	a) b)
G 20		Checking of parallelism of the sliding move- ment of the boring spindle, in relation to a reference plane parallel to the longitudinal movement of the column (axis W).	Fo dia Fo dia NC dia
$\vdash$			

en e		Darmisaih	le deviation
ım	Object	mm	in
<b>,</b>			
<u> </u>	Checking of parallelism of the boring	For a)	and <i>b</i> ):
	spindle axis to the column movement :	0,02	0.0008
\\-\-\\\\\\\\\\\\\\\\\\\\\\\\\\\\	a) in a vertical plane;		 ring length of
H.      <del> </del>	b) in a horizontal plane.		
		300	12
<b>1</b>			8
		AO	
		603010	
		203	
~\$	Checking of squareness of the boring		
	spindle axis to the table movement.	0,02/500	0.0008/20
		CENTROL	
		~®	
	ilon,		
	Checking of straightness of the boring spin- dle movement (sliding spindle) (axis Z):		
a)			
— ∳Ю <b>™</b>	a) in a horizontal plane;	a) 0,02	a) 0.0008
Ω	W.	for a measur	ing length of
<b>b</b> )	CO	300	12
	b) in a vertical plane.	<i>b</i> ) 0,02	b) 0.0008
	3		
		for a measur	
	Pi	300	12
2		For an extension of the spindle eq	Í
CXY		+ 0,015	+ 0.0006
		(upw	
		For an extension of the spindle diameter	equal to four times the spindle :
	Checking of parallelism of the sliding move-	± 0,02	± 0.0008
Φ	ment of the boring spindle, in relation to a reference plane parallel to the longitudinal	For an extension of the spindle	equal to six times the spindle
<b>T</b>	movement of the column (axis W).	diameter:	
		- 0,06	- 0.0024
		(down)	· ·
		NOTE — The extension of the spind diameter and cannot exceed	le is limited to six times the spindle
		900	36
156is +			
ISBN			
·			

Permissible	e deviation	Measuring instruments	Observations
mm	in	3	and references to the test code ISO/R 230
			Clauses 5.412.1 and 5.422.3
For a) a	 and <i>b</i> ) :		Clauses 3.412.1 and 3.422.3
1 Of 27 C			Spindle head locked in mid-travel, table
0,02	0.0008	Dial gauge and possibly test mandrel	locked. The measurement shall be carried out according to the possibilities either touching
for a measur	l ina lenath of	possibly test mandrer	directly the external part of the boring spindle
			or with the aid of a test mandrel mounted in
300	12		the spindle nose (alternative).
			2
			00
•			2:
			40,3
`.			
			(5)
			Clause 5.522.3
0.00/500	0.0000.000	Straightedge and dial	Column and spindle head locked, spindle head
0,02/500	0.0008/20	gauge	in mid-travel. A straightedge laid on the table
and the second s			will be set parallel to the table movement.
		ine till	
•		.ve	
			Clause 5.232.1
		·0	· · · · · · · · · · · · · · · · · · ·
		X	Spindle head locked.
0,02	a) 0.0008	$i_{i_0}$ .	The straightedge shall be set parallel to the
			axial spindle movement; then touch the func-
for a measuri	ng length of	Straightedge, gauge	tional surface of the straightedge with the stylus of a dial gauge fixed on the spindle nose.
300	12	blocks and dial gauge	ctylad ov a dial gaage inter en the opinion
	$\sim$		Repeat the same operations in the two planes:
0,02	b) 0.0008		horizontal and vertical.
for a measuri	ng length of		In the case of a machine having a ram, it shall
		↓ · · · · · · · · · · · · · · · · ·	be maintained locked, in the retracted position.
300	12		position.
xtension of the spindle eq	ual to twice the spindle diameter :		
+ 0,015	+ 0.0006		Clause 5.232.1
(upwa	ards)		Place a straightedge on the machine table and
	equal to four times the spindle		align it, in the vertical containing the spindle.
r (			Adjust the straightedge to bring it in a hori-
. ± 0,02	± 0.0008	Ctroightedan	zontal plane parallel to the column movement.
	equal to six times the spindle	Straightedge, gauge blocks and dial gauge	
r:	oqual to out timos the opinion		Touch the functional surface of the straight-
- 0,06	- 0.0024		edge with a dial gauge fixed on the spindle nose.
(down			
l			Extend the spindle of the requested length and
The extension of the spind and cannot exceed	lle is limited to six times the spindle		note the dial gauge readings for each of the successive positions.
900	36		
ı .		·	

No.	Diagram	Object	
G 21		F — MILLING SPINDLE  a) Measurement of run-out of the milling spindle;  b) Measurement of periodic axial slip;  c) Measurement of camming of the face of the spindle nose (including periodic axial slip.	a) b) c) a) b) c)
G 22		G — RAM  Checking of straightness of the ram movement:  a) in a horizontal plane;  b) in a vertical plane.	a) b)
	Cilch		
G 23	b) <b>1</b>	Checking of parallelism of the ram movement to the column movement :  a) in a horizontal plane;  b) in a vertical plane.	
S			
G 24	a) b)	<ul> <li>a) Checking of concentricity of the milling spindle and of the front centring of tools for accessories on the ram;</li> <li>b) Checking of squareness of the support surface of tools or accessories to the rotation axis of the milling surface.</li> </ul>	a) b)

<del>| | |</del>

The second secon	T	T -		Permissibl	e deviation	on
ım	Object		mm			in
<u>a)</u>			For $D^{(1)} < 1$	25 :		For $D^{(1)} < 5$ :
$\mathbf{Q}_{\mathbf{l}}$	F - MILLING SPINDLE	a)	0,01		a)	0.0004
	a) Measurement of run-out of the milling	b)	0,01		<i>b</i> )	0.0004
	spindle;	c)	0,02		c)	0.0008
	b) Measurement of periodic axial slip;	·	For $D^{(1)} > 1$	25 :		For $D^{(1)} > 5$ :
	c) Measurement of camming of the face of the spindle nose (including periodic axial	a)	0,015		a)	0.0006
	slip.	( b)	0,015		b)	0.0006
		c)	0,030			0.0012
	G — RAM			500 1000		
a)	Checking of straightness of the ram movement:			0		
	a) in a horizontal plane;	a)	0,62		a) .	0.0008
Q.			BO.	for a measuri	ng length	of
<i>b</i> )		(8)	500			20
	b) in a vertical plane.	(b)	0,02		<i>b</i> )	0.0008
	ien			for a measuri	ng length	of
	b) in a vertical plane.		500			20
	Click					
	ON		• .			
	Checking of parallelism of the ram move- ment to the column movement :			For <i>a</i> ) a	nd <i>b</i> ) :	
\$	a) in a horizontal plane;		0,03			0.0012
b) <b>I</b>	b) in a vertical plane.			for a measuri	ng length (	
	in a vertical plane.		500			20
STA						
	4-9-9-9-9-9-9-9-9-9-9-9-9-9-9-9-9-9-9-9		•			
4.3						
b)	a) Checking of concentricity of the milling spindle and of the front centring of tools for accessories on the ram;	a)	0,02		a)	0.0008
+-()	Checking of squareness of the support surface of tools or accessories to the rotation axis of the milling surface.	b)	0,02/500		b)	0.0008/20
17 bis						

Parmissih	le deviation		Observations
mm	in	Measuring instruments	and references to the test code ISO/R 230
or $D^{1} < 125$ :	For $D^{(1)} < 5$ :		a) Clause 5.612.2
0,01	a) 0.0004		b) Clauses 5.622.1 and 5.622.2
0,01	b) 0.0004		The existence, value and direction of ap-
0,02	c) 0.0008	Dial gauge	plication of the force $F$ shall be stated by the manufacturer.
or $D^{(1)} > 125$ :	For $D^{(1)} > 5$ :	Did gaag	c) Clause 5.632
0,015	a) 0.0006		The distance A of dial gauge c) from the
0,015	b) 0.0006		spindle axis shall be as large as possible.
0,030	c) 0.0012		1) $D = \text{diameter of boring spindle.}$
			100
			Clause 5.232.1
			Spindle head locked.
0,02	a) 0.0008		Boring spindle retracted.
	ring length of	Straightedge, gauge	Set the straightedge on the table, parallel to
500	20	blocks and dial gauge 📏	the ram movement; then touch the functional surface of the straightedge with the stylus of a
0,02	b) 0.0008	we'	dial gauge fixed at the end of the ram.
	ring length of	LON'	Repeat the same operations in the two planes : horizontal and vertical.
500	20	Tho in the train	planted vinesal and visited
		-jich	
	and b):		Clauses 5.422.21 and 5.422.22
For <i>a</i> ) 0,03	and b):		A straightedge shall be set parallel to the column movement (W axis), and then the
	ring length of	Straightedge, gauge blocks and dial gauge	column locked in mid-travel.
	20		The ram movement shall then be checked with respect to the straightedge.
500	NO 20		Spindle head locked.
	K.P.		
0,02	a) 0.0008		a) Clause 5.442
		Dial gauge	
0,02/500	b) 0.0008/20		b) Clause 5.512.42
			NOTE — This operation is valid only if there is a circular locating surface on the ram.
		<u>'</u>	

				r
	No.	Diagram	Object	
	G 25	b)	H — INTEGRAL FACING HEAD  Checking of coaxiality of the boring spindle axis and of the facing head axis (in the case of independent rotation movements of the spindle and of the facing head):  a) at the mouth of spindle housing;  b) at a distance from the spindle housing face equal to 300 mm (12 in).	a) b) a) b)
			K of 150	
	G 26 p√	CSISON CITCH CONTROL OF THE PARTY OF THE PAR	Checking of squareness of the facing head axis to the table movement.	
	G 27		Checking of squareness of the facing head axis to the column ways.	
. !	19			

1		Object	Permissible deviation  mm in		
a)					
7		H - INTEGRAL FACING HEAD	$D^{(1)} < 125$ :	$D^{(1)} \leq 5$ :	
<b>V</b>			a) 0,02	(0.0008	
1		Checking of coaxiality of the boring spindle axis and of the facing head axis (in the case			
		of independent rotation movements of the spindle and of the facing head):	b) 0,03	<i>b</i> ) 0.0012	
+			$D^{(1)} > 125$ :	$D^{1)} > 5$ :	
]			a) 0,03	a) 0.0012	
		b) at a distance from the spindle housing face equal to 300 mm (12 in).	<i>b</i> ) 0,04	b) 0.0016	
				3.	
			100		
. •			30,		
			.00		
			A Comment of the comm		
			187		
			FUII .		
			the full PDF of 150.3		
		Checking of squareness of the facing head axis to the table movement.	0,03/10001)	0.0012/401}	
		axis to the table movement.			
		axis to the table movement.			
	•	osiso.com.			
	,				
		all			
	7	<b>Q'</b>			
<del></del>	STATE				
	5				
14	•				
	1				
<del></del>	<b>_</b>	Checking of squareness of the facing head axis to the column ways.	0,03/10001)	0.0012/401)	
111					

19 bis

Permissible	deviation	Measuring instruments	Observations	
mm in			and references to the test code ISO/R 230	
			Clause 5.442	
) < 125 :	$D^{(1)} \leq 5$ :		A dial gauge fixed on the facing head shall	
0,02	a) 0.0008		touch the spindle at the mouth and at 300 mm (12 in).	
0,03	<i>b</i> ) 0.0012		For each operation, half the difference of the	
) > <b>125</b> :	$D^{(1)} > 5$ :	Dial gauge	extreme readings shall be made to obtain the coaxiality deviation.	
0,03	a) 0.0012		This check is valid only if the facing head is mounted on bearings independent of those or	
0,04	<i>b</i> ) 0.0016		the boring spindle.	
			1) $D =$ diameter of boring spindle.	
			20	
			3	
			S	
			\(\delta\)	
•			O <sup>X</sup>	
· ·			Clause 5 500 2 or 5 512 1 and 5 512 12	
		"He full	Clauses 5.522.3 or 5.512.1 and 5.512.42	
		ille	Column and spindle head locked. A straightedge laid on the table shall be se	
		Dial gauge on rigid	parallel to the table movement (X axis).	
.03/10001)	0.0012/401)	support and straightedge	This check is valid only if the facing head is	
		.c. 45:	mounted on bearings independent of those of the boring spindle.	
		Olle		
	al.	•	Distance between the two points touched.	
	CO,			
	60.			
	OSISO.COM.			
	ANDARD			
	ATI		Clauses 5.512.1 and 5.512.42	
Ś			Column locked on its bed; spindle head locked	
			in mid-travel on the column.	
		Dial gauge on rigid	For large machines for which sizes are too	
03/10001)	0.0012/401)	support and possibly straightedge	large, the measuring reference shall be related to a plane parallel to the column slideways.	
		Suaignieuge	This check is valid only if the facing head is	
	*		mounted on bearings independent of those of the boring spindle.	
· · · · · · · · · · · · · · · · · · ·			Distance between the two points touched.	
		¥ 1		

