



SIS - Standardiseringskommissionen i Sverige

Handläggande organ

SMS, SVERIGES MEKANSTANDARDISERING

SVENSK STANDARD **SS-ISO 1984**

Festställt

Utgåva

Sida

Registrering

1992-01-29

1

1 (1 + 20)

SMS reg 48.2952

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Verktygsmaskiner — Fräsmaskiner av bäddtyp med fast bordshöjd och horisontal eller vertikal spindel — Acceptanskontroll

Denna standard utgörs av den engelska versionen av den internationella standarden ISO 1984:1982.

Standarden ersätter SS 3279 (SMS reg 48.295).

Följande dokument, som åberopas i denna standard, är överfört till svensk standard:

ISO/R 230:1961 = SMS 697, utg 1 (SMS reg 47.22), Kontroll av verktygsmaskiner, Sv

Sv betecknar svensk text.

Acceptance conditions for milling machines with table of fixed height with horizontal or vertical spindle — Testing of accuracy

This Swedish standard consists of the English version of the International Standard ISO 1984:1982.

The standard replaces the Swedish standard SS 3279.

The following document, referred to in this standard, has been adopted in a Swedish standard:

Sv indicates Swedish text.

UDK 621.914.3-187

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Prisgrupp P

Tryckt i mars 1992

International Standard 1984

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

Acceptance conditions for milling machines with table of fixed height with horizontal or vertical spindle — Testing of accuracy

Conditions de réception des machines à fraiser à table de hauteur fixe, à broche horizontale ou verticale — Contrôle de la précision

Second edition — 1982-02-01

UDC 621.914.3 - 187

Ref. No. ISO 1984-1982 (E)

Descriptors : machine tools, milling machines, tests, testing conditions, accuracy.

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.

International Standard ISO 1984 was developed by Technical Committee ISO/TC 39, *Machine tools*.

This second edition was submitted directly to the ISO Council, in accordance with clause 5.10.1 of part 1 of the Directives for the technical work of ISO. It cancels and replaces the first edition (i.e. ISO 1984-1974), which had been approved by the member bodies of the following countries :

Belgium	India	South Africa, Rep. of
Chile	Italy	Spain
Czechoslovakia	Japan	Switzerland
Egypt, Arab Rep. of	Korea, Rep. of	Thailand
France	Netherlands	United Kingdom
Germany, F.R.	New Zealand	USA
Greece	Philippines	
Hungary	Portugal	

The member body of the following country had expressed disapproval of the document on technical grounds :

Sweden

Acceptance conditions for milling machines with table of fixed height with horizontal or vertical spindle — Testing of accuracy

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 milling machines with table of fixed height, with horizontal or vertical spindle, and the corresponding permissible deviations which apply.

It deals only with the verification of accuracy of the machine and 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 Reference

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

3 Preliminary remarks

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

3.2 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 mov-

ing 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 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 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.

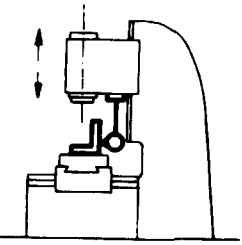
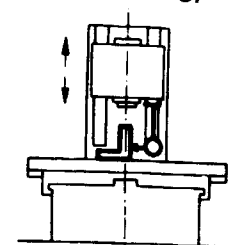
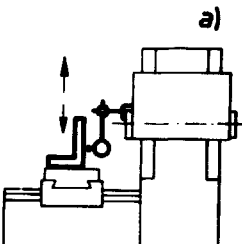
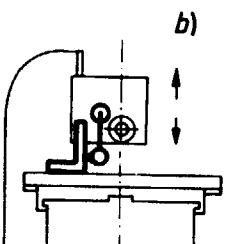
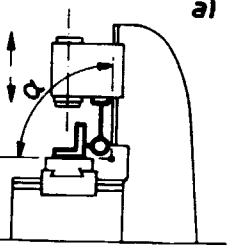
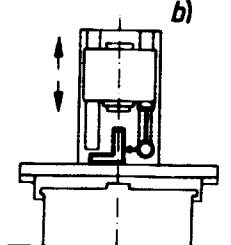
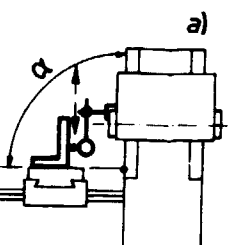
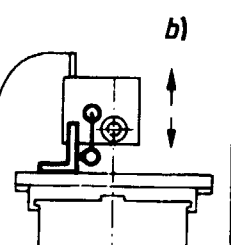
3.5 Practical tests should be made with finishing cuts — for example : depth = 0,1 mm (0,004 in), feed per tooth = 0,1 mm (0,004 in) — and not with roughing cuts which are liable to generate appreciable cutting forces.

3.6 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 0,01 mm (0,000 4 in).

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

4 Test conditions and permissible deviations

4.1 Geometrical tests

No.	Diagram	Object	Permissible deviation		Measuring instruments	Observations and references to the test code ISO/R 230
			mm	in		
G 1	 	<p>Verification of straightness of the vertical movement of the spindle head slide :</p> <p>a) in the vertical plane of symmetry of the machine;</p> <p>b) in the plane perpendicular to the vertical plane of symmetry of the machine.</p>	<p>a) 0,025 for a measuring length of 300</p>	<p>a) 0.001 for a measuring length of 12</p>	Dial gauge and square	<p>Clause 5.232.1.</p> <p>Instead of the straightedge specified in the test code ISO/R 230, use the vertical arm of a square.</p> <p>Table in central position, table and cross slide locked.</p> <p>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 of the machine.</p>
	 		<p>b) 0,025 for a measuring length of 300</p>	<p>b) 0.001 for a measuring length of 12</p>		
G 2	 	<p>Verification of squareness of the table surface to the vertical movement of the spindle head slide :</p> <p>a) in the vertical plane of symmetry of the machine;</p> <p>b) in the plane perpendicular to the vertical plane of symmetry of the machine.</p>	<p>a) 0,025/300 with $\alpha \leq 90^\circ$</p>	<p>a) 0.001/12 with $\alpha \leq 90^\circ$</p>	Dial gauge and square	<p>Clause 5.522.2.</p> <p>Table in central position, cross slide and table locked.</p> <p>Spindle head slide locked when taking measurements.</p> <p>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 of the machine.</p>
	 		<p>b) 0,025/300</p>	<p>b) 0,001/12</p>		

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No.	Diagram	Object	Permissible deviation		Measuring instruments	Observations and references to the test code ISO/R 230
			mm	in		
G 3		<p>Verification of flatness of the table surface.</p>	<p>0,04 up to 1000</p> <p>For each 1 000 mm increase in length, add 0,005</p> <p>Maximum permissible deviation :</p> <p>0,05</p> <p>Local tolerance :</p> <p>0,02</p> <p>for any measuring length of 300</p>	<p>0.0016 up to 40</p> <p>For each 40 in increase in length, add 0.0002</p> <p>Maximum permissible deviation :</p> <p>0.002</p> <p>Local tolerance :</p> <p>0.0008</p> <p>for any measuring length of 12</p>	<p>Precision level or straightedge and slip gauges</p>	<p>Clauses 5.322 and 5.323.</p> <p>Table and cross slide in central position, table not locked, cross slide locked.</p>
G 4		<p>a) Verification of parallelism of the table surface to the transverse movement of the table (or spindle).</p> <p>b) Verification of parallelism of the table surface to the longitudinal movement of the table.</p>	<p>a) 0,025</p> <p>for any measuring length of 300</p> <p>b) 0,025</p> <p>for any measuring length of 300</p> <p>Maximum permissible deviation :</p> <p>0,05</p>	<p>a) 0.001</p> <p>for any measuring length of 12</p> <p>b) 0.001</p> <p>for any measuring length of 12</p> <p>Maximum permissible deviation :</p> <p>0.002</p>	<p>Straightedge and dial gauge</p>	<p>Clause 5.422.21.</p> <p>The stylus of the dial gauge to be placed approximately at the working position of the tool.</p> <p>The measurement may be made on a straightedge laid parallel to the table surface.</p> <p>If the table length is greater than 1 600 mm (64 in), the inspection shall be carried out by successive movements of the straightedge.</p> <p>If the spindle can be locked, then after locking the spindle head slide, the dial gauge may be mounted on it. If the spindle cannot be locked, then the dial gauge shall be placed on a fixed part of the machine.</p> <p>a) table and spindle head slide locked;</p> <p>b) cross slide and spindle head slide locked.</p>
G 5		<p>a) Measurement of run-out of the external centring surface on the spindle nose (for machines having this feature).</p> <p>b) Measurement of periodic axial slip.</p> <p>c) Measurement of camming of the face of the spindle nose (including periodic axial slip).</p>	<p>a) 0,01</p> <p>b) 0,01</p> <p>c) 0,02</p>	<p>a) 0.0004</p> <p>b) 0.0004</p> <p>c) 0.0008</p>	<p>Dial gauge</p>	<p>a) Clause 5.612.2.</p> <p>b) Clauses 5.622.1 and 5.622.2.</p> <p>A force <i>F</i>, specified by the manufacturer of the machine, shall be exerted by pressing towards the housing for tests b) and c).</p> <p>c) Clause 5.632.</p> <p>The distance <i>A</i> of dial gauge c) from the spindle axis shall be as large as possible.</p>

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No.	Diagram	Object	Permissible deviation		Measuring instruments	Observations and references to the test code ISO/R 230
			mm	in		
G 6		<p>Measurement of run-out of the internal taper of the spindle :</p> <p>a) near the mouth of taper;</p> <p>b) at a distance of 300 mm (12 in) from the spindle nose.</p>	<p>a) 0,01</p> <p>b) 0,02</p>	<p>a) 0.0004</p> <p>b) 0.0008</p>	Dial gauge and test mandrel	Clause 5.612.3.
G 7		<p>Verification of parallelism of the spindle axis to the table surface (for horizontal spindle machines only).</p>	<p>0,025 for a measuring length of 300 (free end of the test mandrel inclined downwards)</p>	<p>0.001 for a measuring length of 12 (free end of the test mandrel inclined downwards)</p>	Dial gauge and test mandrel	<p>Clause 5.412.4.</p> <p>Table and cross slide unlocked, spindle head slide locked.</p>
G 8		<p>Verification of squareness of the spindle axis to the table surface (for vertical spindle machines only) :</p> <p>a) in the vertical plane of symmetry of the machine;</p> <p>b) in the plane perpendicular to the vertical plane of symmetry of the machine.</p>	<p>a) 0,025/300 with $\alpha < 90^\circ$</p> <p>b) 0,025/300</p>	<p>a) 0.001/12 with $\alpha < 90^\circ$</p> <p>b) 0.001/12</p>	Dial gauge	<p>Clauses 5.512.1 and 5.512.42.</p> <p>Table, cross slide and spindle head slide locked.</p>

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No.	Diagram	Object	Permissible deviation		Measuring instruments	Observations and references to the test code ISO/R 230
			mm	in		
G 9		<p>Verification of parallelism of the spindle axis to the transverse movement of the table (only for machines with transverse table movement) :</p> <p>a) in the vertical plane;</p> <p>b) in the horizontal plane.</p>	<p>a) 0,025 for a measuring length of 300 (free end of the test mandrel inclined downwards)</p> <p>b) 0,025 for a measuring length of 300</p>	<p>a) 0.001 for a measuring length of 12 (free end of the test mandrel inclined downwards)</p> <p>b) 0.001 for a measuring length of 12</p>	Dial gauge and test mandrel	<p>Clause 5.422.3.</p> <p>Table in central position, spindle head slide locked.</p>
G 10		<p>Verification of straightness of the median or reference tee slot of the table.</p>	<p>0,01 for any measuring length of 500 Maximum permissible deviation :</p> <p>0,03</p>	<p>0.0004 for any measuring length of 20 Maximum permissible deviation :</p> <p>0.001 2</p>	Straightedge and dial gauge or slip gauges, or taut wire and microscope	<p>Clauses 5.212, 5.212.1, 5.212.3 or 5.232.</p> <p>The straightedge may be placed directly on the table.</p>
G 11		<p>Verification of squareness of the spindle axis to the median or reference tee slot of the table (for horizontal spindle machines only).</p>	<p>0,02/300*</p>	<p>0.0008/12*</p>	Dial gauge	<p>Clauses 5.512.1 and 5.512.52.</p> <p>Table in central position.</p> <p>Table, cross slide and spindle head slide locked.</p> <p>* Distance between the two points touched.</p>
G 12		<p>Verification of parallelism of the median or reference tee slot to the longitudinal movement of the table.</p>	<p>0,015 for any measuring length of 300 Maximum permissible deviation :</p> <p>0,04</p>	<p>0.0006 for any measuring length of 12 Maximum permissible deviation :</p> <p>0.0016</p>	Dial gauge	<p>Clauses 5.422.1 and 5.422.21.</p> <p>Cross slide and spindle head slide locked.</p> <p>If the spindle can be locked, the dial gauge may be mounted on it. If the spindle cannot be locked, then the dial gauge shall be placed on a fixed part of the machine.</p>

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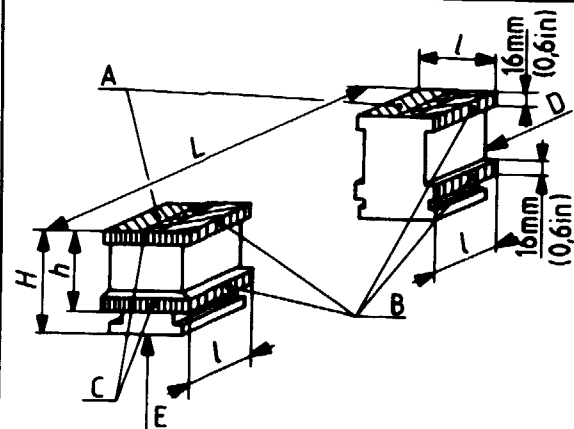
No.	Diagram	Object	Permissible deviation		Measuring instruments	Observations and references to the test code ISO/R 230
			mm	in		
G 13		<p>Verification of squareness of the transverse movement of the table (or spindle) to the longitudinal movement of the table.</p>	0,02/300	0.0008/12	Straightedge, dial gauge and square	<p>Clause 5.522.4.</p> <p>a) The straightedge shall be set parallel to the table longitudinal movement; then the square shall be placed against the straightedge. The table shall then be locked in central position.</p> <p>b) The table transverse movement shall then be checked.</p> <p>If the spindle can be locked, then after locking the spindle head slide, the dial gauge may be mounted on it. If the spindle cannot be locked, then the dial gauge shall be placed on a fixed part of the machine.</p>
G 14		<p>Verification of parallelism of arbor support guide on the over arm (or arms) to the spindle axis :</p> <p>a) in the vertical plane;</p> <p>b) in the horizontal plane.</p>	<p>a) 0,02 for a measuring length of 300 (over arm inclined downwards)</p> <p>b) 0,02 for a measuring length of 300</p>	<p>a) 0.0008 for a measuring length of 12 (over arm inclined downwards)</p> <p>b) 0.0008 for a measuring length of 12</p>	Dial gauge and possibly precision level	<p>Clause 5.412.5 or clauses 5.412.1 and 5.412.3. Clause 5.422.4. Over arm(s) locked.</p>
	<p>Alternative</p>	<p>Verification of parallelism of arbor support guide on the over arm (or arms) to the transverse movement of the table :</p> <p>a) in the vertical plane;</p> <p>b) in the horizontal plane.</p>	<p>a) 0,02 for a measuring length of 300 (over arm inclined downwards)</p> <p>b) 0,02 for a measuring length of 300</p>	<p>a) 0.0008 for a measuring length of 12 (over arm inclined downwards)</p> <p>b) 0.0008 for a measuring length of 12</p>		

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No.	Diagram	Object	Permissible deviation		Measuring instruments	Observations and references to the test code ISO/R 230
			mm	in		
G 15		<p>Verification of coincidence of the axis of the bore of the arbor support with the spindle axis :</p> <p>a) in the vertical plane;</p> <p>b) in the horizontal plane.</p>	<p>a) 0,03 (axis of the bore of the arbor support lower than the spindle axis)</p> <p>b) 0,03</p>	<p>a) 0.0012 (axis of the bore of the arbor support lower than the spindle axis)</p> <p>b) 0.0012</p>	<p>Dial gauge and test mandrel</p>	<p>Clauses 5.442 and 5.422.4.</p> <p>Arbor support located 300 mm (12 in) away from the spindle nose.</p> <p>The measurement shall be made as near as possible to the arbor support.</p> <p>Over arm locked and arbor support not connected to the machine bed.</p>
	<p>First alternative</p>		<p>a) 0,04 for any measuring length of 300 (mandrel inclined downwards on the side of the bore of the arbor support).</p> <p>b) 0,03 for any measuring length of 300</p>	<p>a) 0.0016 for any measuring length of 12 (mandrel inclined downwards on the side of the bore of the arbor support).</p> <p>b) 0.0012 for any measuring length of 12</p>		<p>A) The end of the mandrel or cutter arbor is held by the arbor support.</p> <p>B) The arbor support is positioned mid-way along the mandrel or cutter arbor.</p> <p>The reading observed on the dial gauge shall not be divided by 2.</p>
	<p>Second alternative</p>					

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4.2 Practical test

No.	Diagram and sizes of test pieces	Nature of test	Cutting conditions	Checks to be applied	Permissible deviation		Measuring instruments	Observations and references to the test code ISO/R 230
					mm	in		
P 1	 <p>L (length of the test piece or distance between the opposite faces of two test pieces) = 1/2 longitudinal travel</p> <p>$l = h = 1/8$ longitudinal travel</p> <p>l max. = 100 mm (4 in) : for $L < 500$ mm (20 in) 150 mm (6 in) : for 500 mm (20 in) $< L < 1\,000$ mm (40 in) 200 mm (8 in) : for $L > 1\,000$ mm (40 in)</p> <p>l min. = 50 mm (2 in)</p> <p>NOTES (concerning vertical and horizontal milling machines)</p> <ol style="list-style-type: none"> Longitudinal travels > 400 mm (16 in) : use one or two test pieces, to be machined in the longitudinal direction over a length l at each end. Longitudinal travels < 400 mm (16 in) : use only one test piece, to be machined over its entire length. Material : cast iron or steel. 	<p>A – Vertical milling machines</p> <p>Milling of surface A by automatic longitudinal movement of the table and manual transverse movement of the cross slide in two cuts overlapping by about 5 to 10 mm (0.2 to 0.4 in).</p> <p>Milling of strips of surfaces B, C and D by automatic longitudinal movement of the table, automatic transverse movement of the cross slide and manual vertical movement of the spindle head slide.</p>	<p>With a shell end mill</p> <p>Slab milling with the same cutter</p>	<p>a) Surface A on each block shall be flat.</p> <p>b) The height H of the block (or blocks) shall be constant.</p> <p>The planes containing the strips of surfaces B, C and D shall be perpendicular to each other and each one shall be perpendicular to the surface A.</p>	0,02	0.0008	<p>Straightedge and slip gauges or amplifier, micrometer callipers</p> <p>Square and slip gauges</p>	<p>Clauses 3.1 and 3.22.</p> <p>Clauses 4.1 and 4.2.</p> <p>Before beginning the test, make sure that surface E is flat.</p> <p>Test pieces shall be placed in the longitudinal axis of the table so that the length L is equally distributed on either side of the table centre.</p> <p>NOTE – Subject to agreement between the user and the manufacturer, the form of test piece shown in the diagram may be replaced by a simpler form of test piece having sides of full width, in which case tests carried out using this form will be at least as severe as those carried out using the form in the diagram.</p>
		<p>B – Horizontal milling machines</p> <p>Milling of surface B by automatic longitudinal movement of the table and manual vertical movement of the spindle head in two cuts overlapping by about 5 to 10 mm (0.2 to 0.4 in).</p> <p>Milling of strips of surfaces A, C and D by automatic longitudinal movement of the table, automatic vertical movement of the spindle head slide and manual transverse movement of the cross slide.</p>	<p>With a shell end mill</p> <p>Slab milling with the same cutter</p>	<p>Surface B on each block shall be flat.</p> <p>a) The planes containing the strips of surfaces C, A and D shall be perpendicular to each other and each one shall be perpendicular to the surface B.</p> <p>b) The height H of the block (or blocks) shall be constant.</p>	0,02	0.0008		

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