INTERNATIONAL STANDARD

ISO
8636-1

First edition
1987-04-01

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

STANDARDSISO.COM : Click to view the full PDF of ISO 8636-1:1987

Acceptance conditions for plano-milling machines — Testing of the accuracy —

Part 1:
Portal-type machines

Conditions de réception des machines à fraiser à portique — Contrôle de la précision —

Partie 1: Machines à portique fixe

Reference number
ISO 8636-1 : 1987 (E)

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. Each 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 8636-1 was prepared by Technical Committee ISO/TC 39, *Machine tools*.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

STANDARDSISO.COM : Click to view the full PDF of ISO 8636-1:1987

© International Organization for Standardization, 1987 ●

Printed in Switzerland

Acceptance conditions for plano-milling machines — Testing of the accuracy —

Part 1 : Portal-type machines

STANDARDSISO.COM : Click to view the full PDF of ISO 8636-1:1987

1 Scope and field of application

This part of ISO 8636 specifies, with reference to ISO 230-1, preliminary tests, geometrical tests and practical tests for portal-type plano-milling machines which apply to general purpose, normal accuracy, machines and gives the corresponding permissible deviations.

This part of ISO 8636 is applicable to machines with moving tables and fixed double columns. It does not include single-column (open-sided) machines and those with fixed tables and moving columns.

This part of ISO 8636 deals only with checking the machine accuracy. It does not apply to the testing of the running of the machine (vibration, abnormal noise, stick-slip motion of components, etc.) nor to the machine characteristics (speeds, feeds etc.) which should generally be checked before testing the accuracy.

This part of ISO 8636 provides the nomenclature used for the principal parts of the machine and the designation of the axes.

NOTE — In addition to terms used in the three official ISO languages (English, French and Russian), this part of ISO 8636 gives the equivalent terms in the German and Italian languages in an annex; these have been included at the request of ISO Technical Committee ISO/TC 39 and are published under the responsibility of the member bodies for Germany, F.R. (DIN) and Italy (UNI). However, only terms given in the official languages can be considered as ISO terms.

2 Reference

ISO 230-1, *Acceptance code for machine tools — Part 1: Geometric accuracy of machines operating under no-load or finishing conditions.*

3 Preliminary observations

3.1 In this part of ISO 8636, all dimensions and deviations are expressed in millimetres and in inches.

3.2 To apply this part of ISO 8636, reference should be made to ISO 230-1, especially for the installation of the machine before testing, warming up of spindle and other moving parts, description of measuring methods and recommended accuracy of testing equipment.

3.3 The temperature conditions throughout the tests shall be specified by agreement between manufacturer and user.

3.4 The sequence in which geometrical tests are given is related to the sub-assemblies of the machine and in no way defines the practical order of testing. In particular, to make instrument mounting or gauging easier, tests may be applied in any order.

3.5 When inspecting a machine, it is not always necessary to carry out all the tests given in this part of ISO 8636. It is up to the user to choose, in agreement with the manufacturer, those tests relative to the properties which are of interest to him, but these tests are to be clearly stated when ordering a machine.

3.6 Practical tests shall be carried out with finishing cuts and not with roughing cuts which are liable to generate appreciable cutting forces.

3.7 When establishing the tolerance for a measuring range different from that given in this part of ISO 8636 (see subclause 2.311 of ISO 230-1), it should be taken into consideration that the minimum value of tolerance is 0,005 mm (0.000 2 in).

3.8 For reasons of simplicity, the diagrams in this part of ISO 8636 are based on a single machine type.

4 Definitions and description

4.1 Definitions of the machining processes that can be carried out

4.1.1 Milling operations

Milling is a machining operation which consists of removing material by means of a rotary tool called a "milling cutter" of which there are several different types. The usual operations of milling mostly involve face milling or end milling. The tools are mounted either in the spindle taper or on the spindle front face.

4.1.2 Boring operations

Boring consists of machining the diameters of cylindrical, conical, blind or through holes, to the required size.

4.1.3 Drilling and tapping operations

These operations consist of drilling and/or tapping blind or through holes.

4.2 Definition of plano-milling machines and main types

4.2.1 Definition

portal-type plano-milling machine: Double-column machine with one or more vertical spindle heads mounted on the cross-rail, above a table which has longitudinal traverse only.

Additional horizontal spindle heads may be mounted on the columns, of which the horizontal spindle axes may be inclinable.

4.2.2 Main types of machines

These machines are classified into two types depending upon construction:

— plano-milling machines with a movable height cross-rail and a bridge or tiepiece between the columns;

— plano-milling machines with a fixed height cross-rail which may replace the bridge or tiepiece.

4.3 Description

See 5.1, in which the numbers are explained.

4.3.1 Bed and table

The bed (1) is the fixed base of the machine which may be constructed of several parts. It supports the table (3) which moves parallel to the major axis of the bed.

4.3.2 Column, cross-rail and tiepiece or bridge

The columns (4) and (5) provide the vertical frame of the machine and are fixed on either side of the bed.

The columns may be fitted with vertical slideways to accommodate a side milling head (9) with a horizontal or inclinable spindle axis.

The bridge or tiepiece (10) is a fixed piece connecting both columns at or near the top.

The cross-rail (7) has its major axis parallel to the table plane and is fitted with horizontal slideways on which one or more milling heads (8) with vertical or inclinable spindles can move.

The variable height cross-rail may be moved up and down the vertical slideways (6) on the columns.

In the case of machines with fixed height cross-rail, the latter is also fastened to the columns and may replace the bridge or tiepiece.

4.3.3 Milling head

These heads include the spindle and driving mechanism and the ways for mounting on the cross-rail or column. In some cases the spindle may be mounted in a ram or quill (12) with a feed motion for drilling or boring operations.

4.3.4 Cutting motion

Cutting motion is provided by the spindles and drive mechanisms of the milling heads.

4.3.5 Feed motion

The following feed movements may be provided with constant or variable feed rate:

— horizontal movement of the table;

— horizontal or vertical movement of the cross-rail or column heads;

— vertical movement of spindle rams or quills (if any);

— vertical movement of the cross-rail (if any).

NOTE — In general, rapid traverse is available in addition to feed movement.

STANDARDSISO.COM : Click to view the full PDF of ISO 8636-1:1987

5 Nomenclature and designation of axes

5.1 Nomenclature

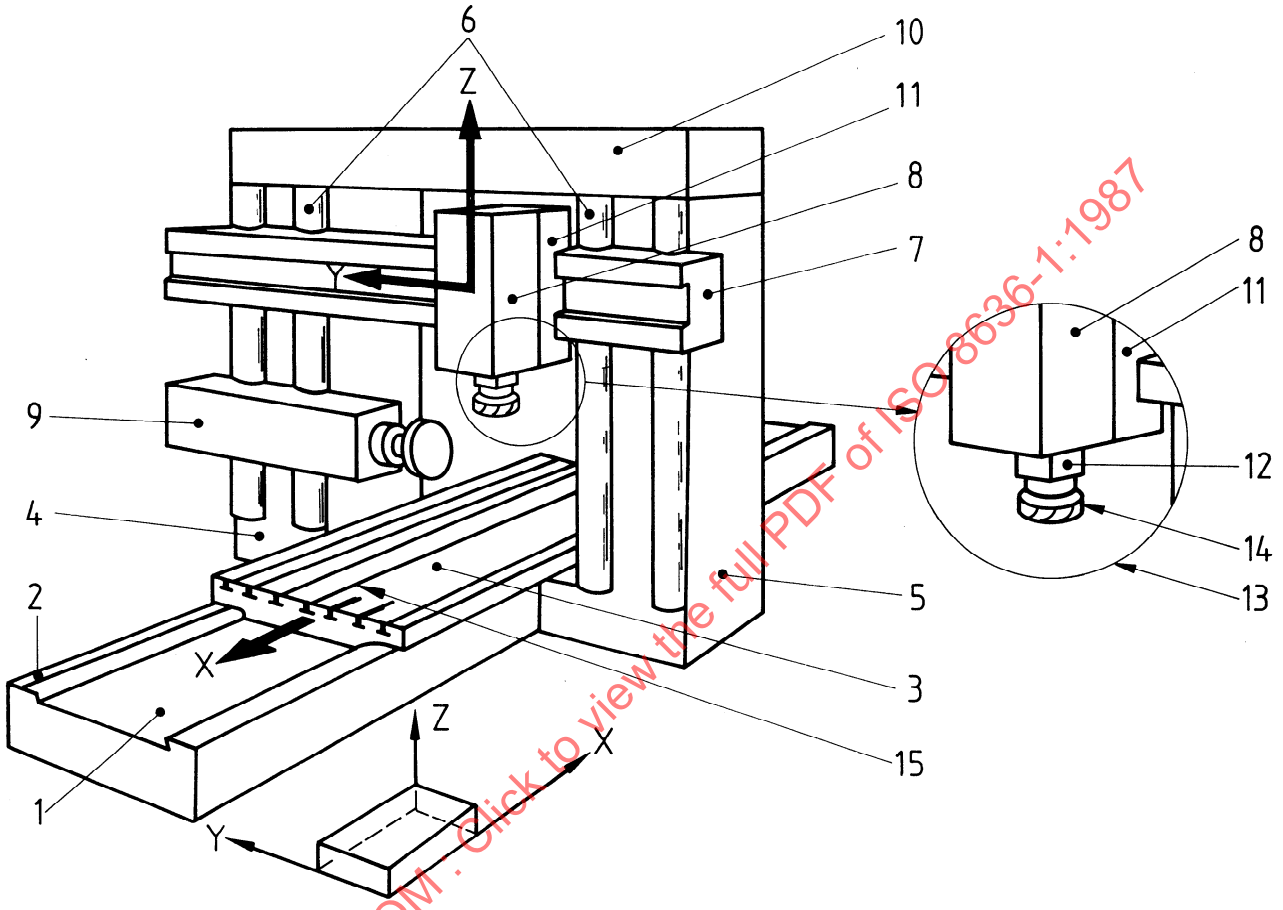
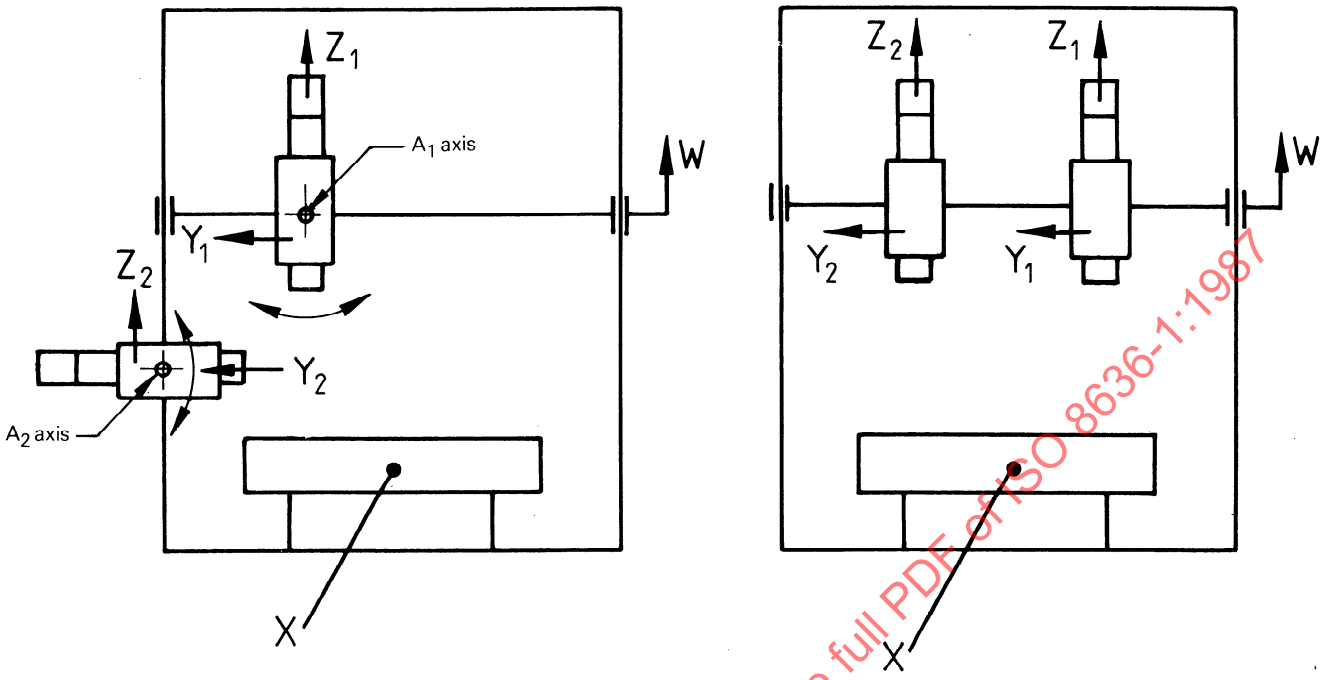


Figure 1 — Portal-type plano-milling machine with variable height cross-rail

Ref.	Designation		
	English	French	Russian
1	Bed	Banc	Станина
2	Slideway, bed	Glissière du banc	Направляющая станины
3	Table (clamping surface)	Table (surface de bridage)	Стол (рабочая поверхность)
4	Left-hand column	Montant gauche	Левая стойка
5	Right-hand column	Montant droit	Правая стойка
6	Slideway, right-hand and left-hand column	Glissière des montants droit et gauche	Направляющая левой и правой стоек
7	Cross-rail (movable, fixed)	Traverse (mobile, fixe)	Траверса (подвижная, неподвижная)
8	Vertical milling head	Tête de fraisage verticale	Головка вертикально-фрезерная
9	Horizontal milling head (side head)	Tête de fraisage horizontale	Головка горизонтально-фрезерная
10	Bridge (tiepiece)	Entretoise	Поперечная балка
11	Bottom slide (saddle)	Cuirasse	Каретка суппорта
12	Quill (ram)	Coulant (fourreau)	Ползун (втулка)
13	Milling spindle	Broche porte-fraise	Шпиндель фрезы
14	Tool (milling cutter)	Outil (fraise, tourteau)	Инструмент (фреза)
15	Reference T-slot	Rainure de référence	Базовый паз

STANDARDSISO.COM : Click to view the full PDF of ISO 8636-1:1987

5.2 Designation of axes



a) one tilting spindle milling head on the A_1 axis, placed on the cross-rail, and one tilting spindle milling head on the A_2 axis, placed on the right- or left-hand column

b) two milling heads on the cross-rail

Figure 2 — Type 1: Machine with two milling heads

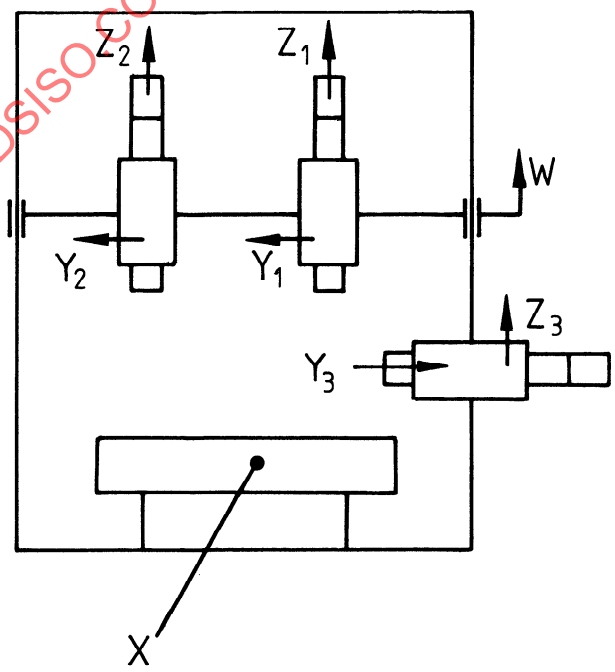


Figure 3 — Type 2: Machine with three milling heads

STANDARDSISO.COM : Click to view the full PDF of ISO 8636-1:1987

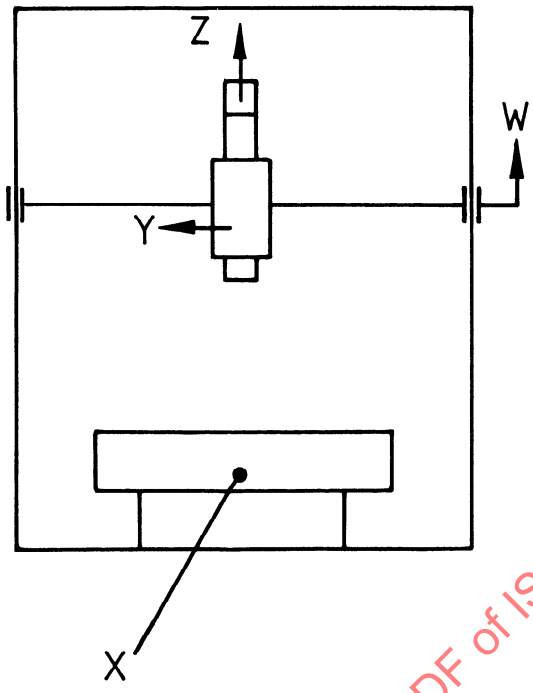


Figure 4 — Type 3: Machine with one milling head on the cross-rail

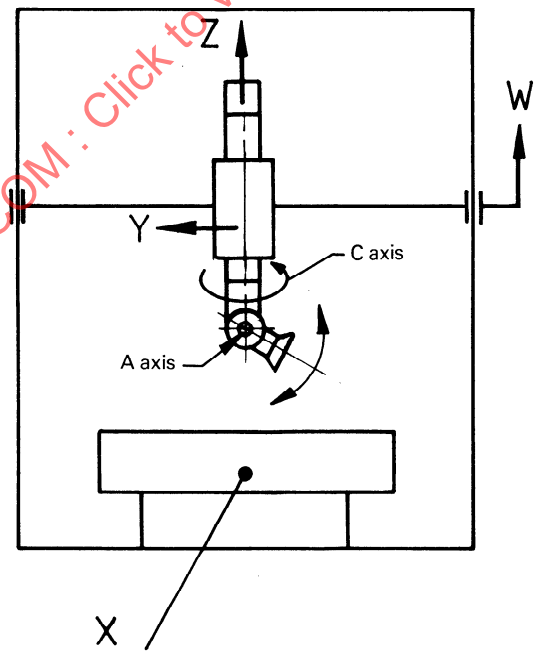
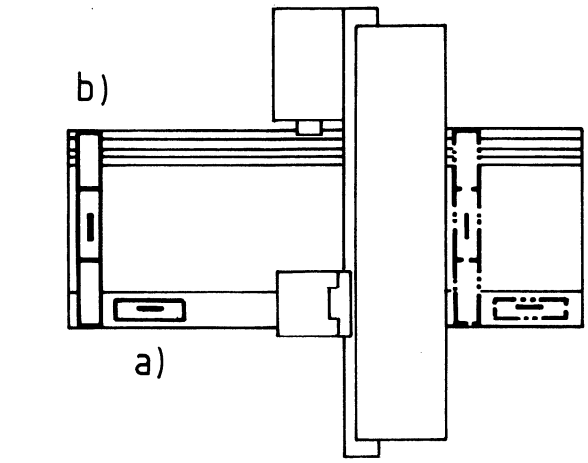
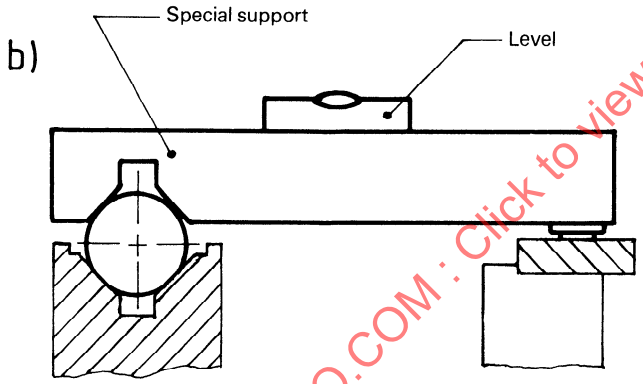
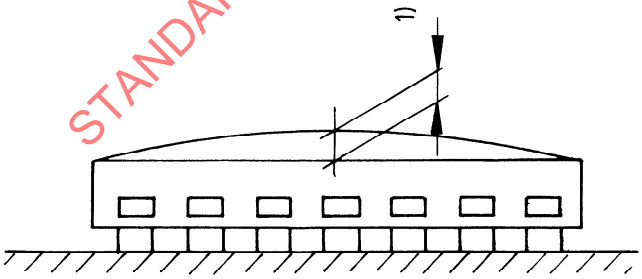


Figure 5 — Type 4: Machine with one milling head on the cross-rail and an additional milling head swivelling on axes C and A

STANDARDSISO.COM : Click to view the full PDF of ISO 8636-1:1987

6 Test conditions and permissible deviations

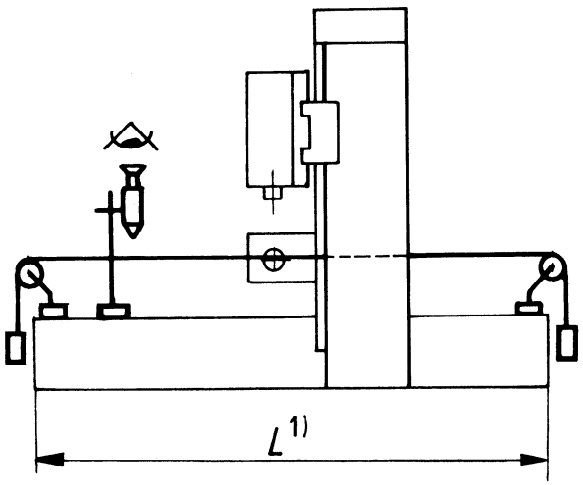
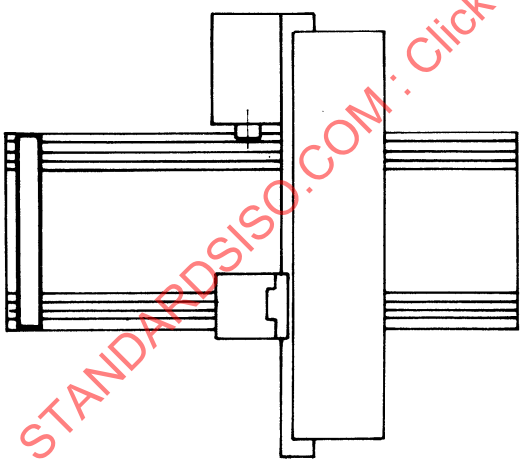
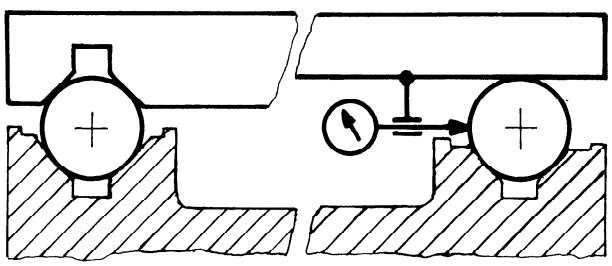
6.1 Preliminary tests

No.	Diagram	Object
G01	  Particular bed shape indicated by the manufacturer 	**A — Bed** Verification of levelling of bed slideways [1]: a) Longitudinal verification: checking of accuracy of slideways in a vertical plane. b) Transverse verification: checking of position of slideways with respect to one another.

STANDARDSISO.COM : Click to view the full PDF of ISO 8636-1:1987

Permissible deviation		Measuring instruments	Observations and references to the ISO 230-1 acceptance code
mm	in		
			Sub-clauses 3.1 and 3.2
Local tolerance:			Table dismounted.
a)			a) Place level in the longitudinal direction on each slideway at a number of equally spaced positions along the bed length.
0,02	0.000 8		
over any measured length (flat or convex) of			
1 000	40		
b)		Straightedge, precision levels, special support	b) Place the special support and level in the transverse direction on each slideway. It shall not indicate slope variations exceeding the tolerance at any measuring point over the bed length.
0,02/1 000	0.000 8/40		Such checks shall be carried out when mounting the machine.
			1) The shape characteristics of the bed basic plane from which the permissible deviation is measured shall be supplied graphically or described by the manufacturer.

STANDARDSISO.COM : Click to view the full PDF of ISO 8636-1:1987

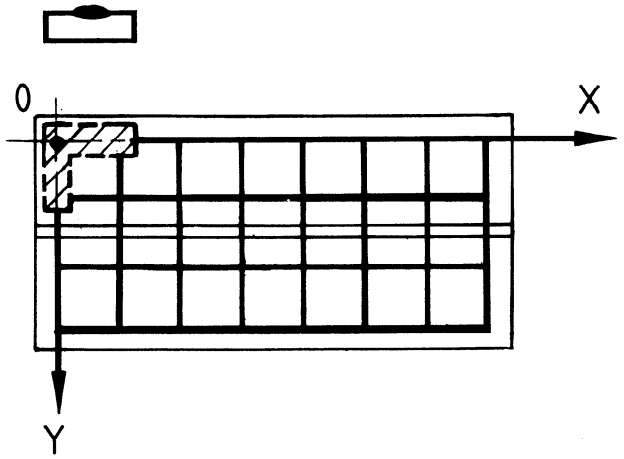
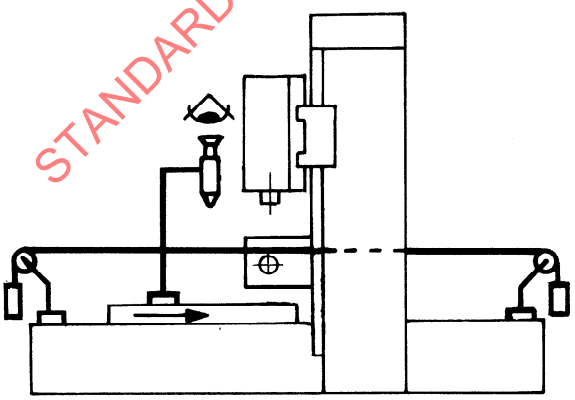
No.	Diagram	Object
G02		Checking of straightness of bed reference slideways in a horizontal plane.
G03	 	Checking of parallelism of bed reference slideways in a horizontal plane (for machines with two reference slideways).

STANDARDSISO.COM : Click to view the full PDF of ISO 8636-1:1987

Permissible deviation		Measuring instruments	Observations and references to the ISO 230-1 acceptance code
mm	in		
0,02 for L[1] $\leqslant$ 2 000 0,03 for 2 000 $<$ L $\leqslant$ 4 000 0,05 for 4 000 $<$ L $\leqslant$ 10 000 0,08 for 10 000 $<$ L $\leqslant$ 20 000 0,12 for L $>$ 20 000 Local tolerance: 0,01 over any measured length of 500	0.000 8 for L[1] $\leqslant$ 80 0.001 2 for 80 $<$ L $\leqslant$ 160 0.002 for 160 $<$ L $\leqslant$ 400 0.003 for 400 $<$ L $\leqslant$ 800 0.005 for L $>$ 800 0.000 4 20	Microscope and taut wire or any other optical instrument, special support or measuring carriage	Sub-clauses 5.212.3 and 5.222 Dismounted table. Fix taut wire to each end of slideway, stretch and orientate it. Place and orientate special support and microscope on slideway. Move special support on slideway at different, equally spaced, positions and read the variation in the recorded value. In the case of machines with two V-shaped slideways, testing can be carried out by checking straightness for one slideway and parallelism for the other. 1) L is the slideway length.
0,02 whichever is the distance between slideways in the horizontal plane	0.000 8	Special support or measuring carriage and dial gauge	Sub-clause 5.412.6 Place the special support on one of the reference slideways and on the opposite slideway. Move the special support along the slideways through various, equally spaced, positions. Read the variation in the dial gauge indication.

STANDARDSISO.COM : Click to view the full PDF of ISO 8636-1:1987

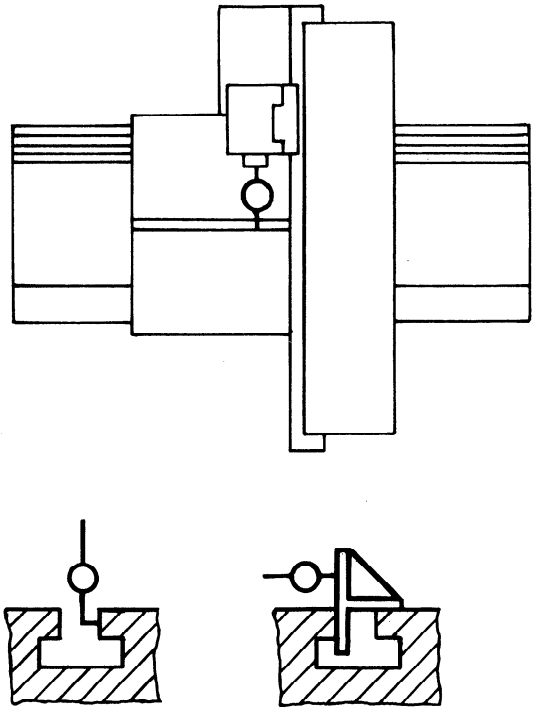
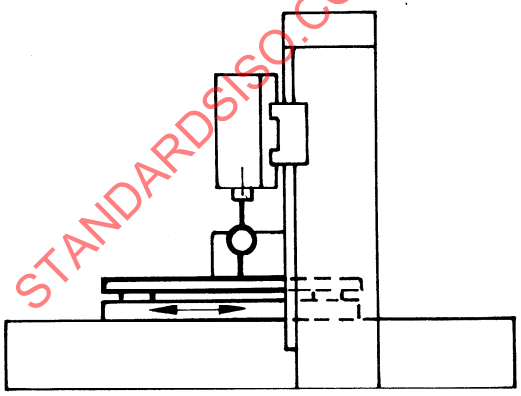
6.2 Geometrical tests

No.	Diagram	Object
G1		**B – Table** Checking of flatness of table surface.
G2		Checking of straightness of movement of table on bed in a horizontal plane.

STANDARDSISO.COM : Click to view the full PDF of ISO 8636-1:1987

Permissible deviation		Measuring instruments	Observations and references to the ISO 230-1 acceptance code
mm	in		
x [1] $\leqslant$ 1 000	x [1] $\leqslant$ 40	Precision levels and support with contact points spaced 500 mm (20 in) apart or optical means	Sub-clauses 5.322, 5.323 and 5.324 Table at mid-travel (mid-position). Place the level on the surface of the table at different positions spaced 500 mm (20 in) apart. Tolerance as stated should not be applied if y is greater than 3 000 mm (120 in) but should be agreed upon between manufacturer and user. 1) For x dimensions along axis X. 2) For y dimensions along axis Y.
0,02	0.000 8		
1 000 $< x \leqslant$ 2 000	40 $< x \leqslant$ 80		
0,03	0.001 2		
2 000 $< x \leqslant$ 5 000	80 $< x \leqslant$ 200		
0,04	0.001 6		
5 000 $< x \leqslant$ 10 000	200 $< x \leqslant$ 400		
0,05	0.002		
10 000 $< x$	400 $< x$		
0,08	0.003		
whichever is the value y [2] up to			
3 000	120		
0,02 for L [1] $\leqslant$ 2 000	0.000 8 for L [1] $\leqslant$ 80	Microscope and taut wire or other optical instrument	Sub-clauses 5.212.2, 5.212.3 and 5.232.2 Fix taut wire to each end of the bed, stretch and orientate it. Fix and orientate microscope on the table. Move table and read indications. 1) L is the length of movement.
0,04 for 2 000 $< L \leqslant$ 5 000	0.001 6 for 80 $< L \leqslant$ 200		
0,06 for 5 000 $< L \leqslant$ 10 000	0.002 4 for 200 $< L \leqslant$ 400		
0,08 for $L >$ 10 000	0.003 for $L >$ 400		
Local tolerance:			
0,01	0.000 4		
over any measuring length of			
1 000	40		

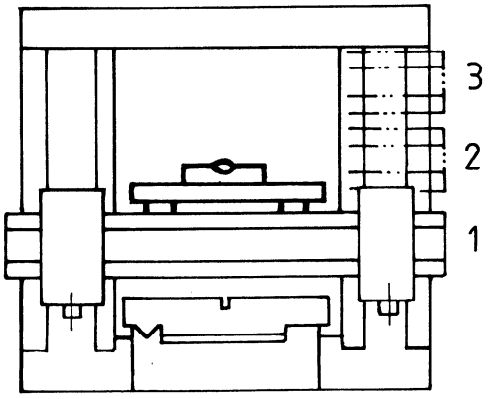
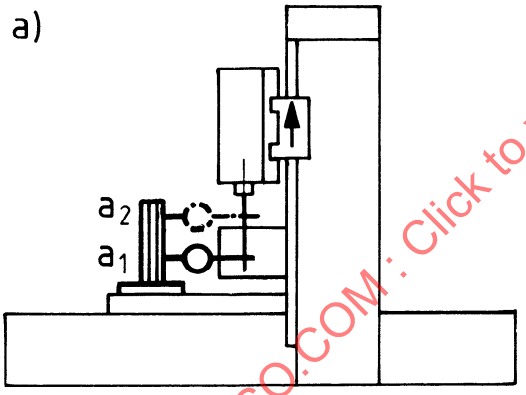
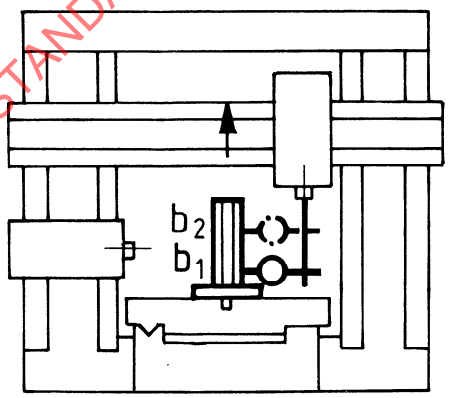
STANDARDSISO.COM : Click to view the full PDF of ISO 8636-1:1987

No.	Diagram	Object
G3		Checking in the horizontal plane of parallelism of reference T-slot of table to longitudinal movement (X axis).
G4		Checking in the vertical plane of parallelism of table surface to its movement.

STANDARDSISO.COM : Click to view the full PDF of ISO 8636-1:1987

Permissible deviation		Measuring instruments	Observations and references to the ISO 230-1 acceptance code
mm	in		
0,02 for L[1] $\leqslant$ 2 000 0,04 for 2 000 $<$ L $\leqslant$ 5 000 0,06 for 5 000 $<$ L $\leqslant$ 10 000 0,08 for L $>$ 10 000 Local tolerance: 0,02 over any measuring length of 1 000	0.000 8 for L[1] $\leqslant$ 80 0.001 6 for 80 $<$ L $\leqslant$ 200 0.002 4 for 200 $<$ L $\leqslant$ 400 0.003 for L $>$ 400 0.000 8 40	Dial gauge support, dial gauge and T-square	Sub-clauses 5.422.1 and 5.422.21 Lock cross-rail and milling head. Fix dial gauge support and dial gauge to a fixed part of the machine. Place gauge stylus in contact with measuring face of reference T-slot. Move table through one milling travel and read indication variation. 1) L is the milling length.
0,015 for L[1] $\leqslant$ 2 000 0,02 for 2 000 $<$ L $\leqslant$ 5 000 0,03 for 5 000 $<$ L $\leqslant$ 10 000 0,04 for L $>$ 10 000 Local tolerance: 0,01 over any measuring length of 1 000	0.000 6 for L[1] $\leqslant$ 80 0.000 8 for 80 $<$ L $\leqslant$ 200 0.001 2 for 200 $<$ L $\leqslant$ 400 0.001 6 for L $>$ 400 0.000 4 40	Dial gauge support, dial gauge, straightedge and gauge blocks	Sub-clauses 5.412.2 and 5.422.22 Place the cross-rail in the lower position and the milling head in the mid-position on the cross-rail. Fix dial gauge support and dial gauge to milling head. Place straightedge and orientate it in the longitudinal direction (X axis). Place gauge stylus in contact with straightedge. Move table through one milling travel and read indication. In the case of very long machines, gauge blocks may be used instead of the straightedge. Repeat the test in two other positions of the milling head, symmetrical to the previous position. The stated tolerances assume that finished machining is carried out after assembly. If not, the permissible deviation should be agreed upon by the manufacturer and user. 1) L is the milling length.

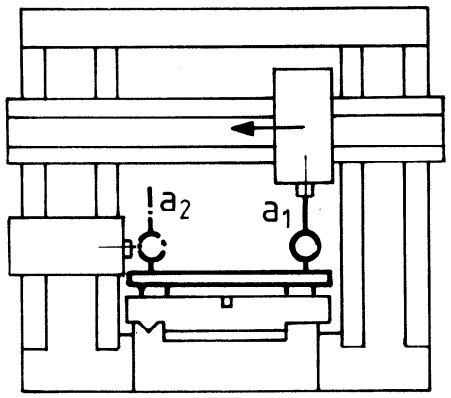
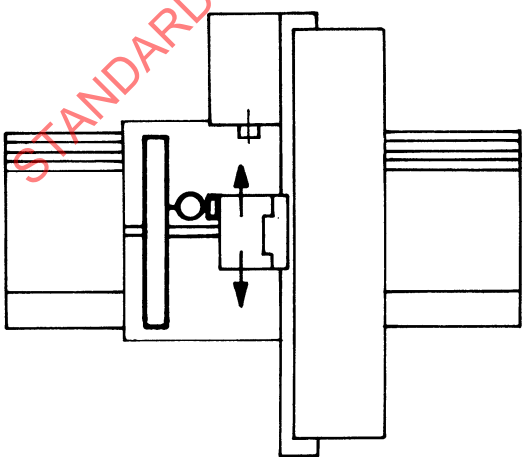
STANDARDSISO.COM : Click to view the full PDF of ISO 8636-1:1987

No.	Diagram	Object
G5		**C — Gantry** Checking in the vertical plane of slope variation of cross-rail during displacement **1**: in the lower position, **2**: in the mid-position, **3**: in the higher position, a) for the cross-rail fixed, when working without mechanical indexing; b) for other cases.
G6	a)  b) 	Checking of squareness of cross-rail vertical movement to the reference plane a) in a longitudinal plane (X axis); b) in a transverse plane (Y axis).

STANDARDSISO.COM : Click to view the full PDF of ISO 8636-1:1987

Permissible deviation		Measuring instruments	Observations and references to the ISO 230-1 acceptance code
mm	in		
a) 0,03/1 000	0.001 2/40	Precision levels	Sub-clause 5.212.2 Place level at mid-position of cross-rail on an adequate face and read the indication in the quoted positions. Place milling heads symmetrically. For machines with only a single milling head, it shall be placed in a central position. Lock cross-rail at each position.
b) 0,02/1 000	0.000 8/40		
at checking positions			
0,03/500	0.001 2/20	Dial gauge support, dial gauge, cylindrical square and surface plate or straightedge	Sub-clause 5.522.2 Lock table in mid-position. Fix dial gauge support and dial gauge to milling head. Lock milling head to cross-rail. Using a surface plate placed in the centre of the table and oriented parallel to the reference plane, position square cylinder, then place dial gauge stylus in a longitudinal plane at position a_1 on the square cylinder. Move cross-rail to position a_2 and read indication. Rotate square cylinder 180° and repeat checking in the same sequence. Determine average value of actual deviations. Check subsequently in a transverse plane at positions b_1 and b_2. For machines of large dimensions, the check may be made in the mid-position and in two extreme positions of the milling head on the cross-rail.

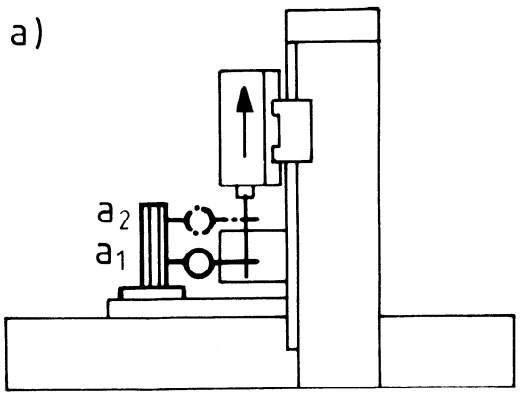
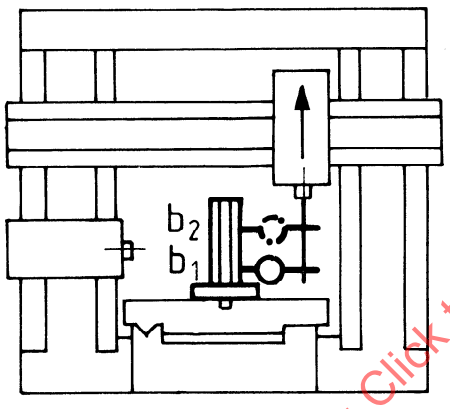
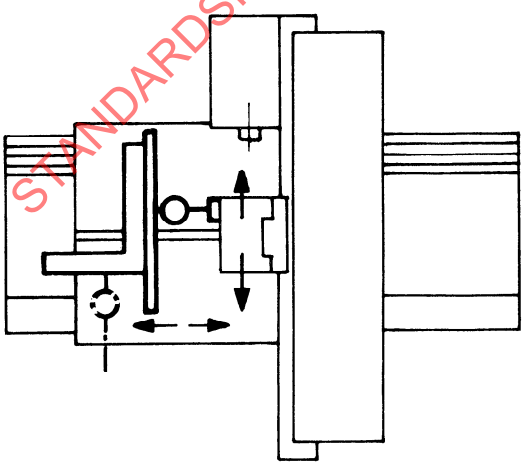
STANDARDSISO.COM : Click to view the full PDF of ISO 8636-1:1987

No.	Diagram	Object
G7		**D — Milling head** Checking of parallelism in a vertical plane of transverse movement of milling head (Y axis) to the table surface a) for the cross-rail fixed, when working without mechanical indexing; b) for other cases.
G8		Checking of straightness in the horizontal plane of transverse movement of the milling head on the cross-rail.

STANDARDSISO.COM : Click to view the full PDF of ISO 8636-1:1987

Permissible deviation		Measuring instruments	Observations and references to the ISO 230-1 acceptance code
mm	in		
a)			
0,03	0.001 2		
for $L^{1)} \leqslant 1\,000$	for $L^{1)} \leqslant 40$		
For each additional 500 mm (20 in) beyond 1 000 mm (40 in), increase this tolerance by			Sub-clause 5.422.22
0,01	0.000 4		Table at mid-position.
b)			Fix dial gauge support and dial gauge to milling head.
0,02	0.000 8		
for $L \leqslant 1\,000$	for $L \leqslant 40$		Place straightedge and orientate it in the transverse direction.
For each additional 500 mm (20 in) beyond 1 000 mm (40 in), increase this tolerance by			
0,01	0.000 4	Dial gauge support, dial gauge, straightedge and gauge blocks	Place dial gauge stylus at position $\mathbf{a_1}$ on straightedge. Move milling head to point $\mathbf{a_2}$ and read indication variation.
a) and b)			
Local tolerance:			Carry out test in the cross-rail lower position.
0,02	0.000 8		
over any measuring length of			In the case of an additional head, carry out the same test.
1 000	40		
Maximum permissible deviation:			For machines of large dimensions, the check may be made in the mid-position and in two extreme positions of the table.
0,06	0.002 4		
for $L \leqslant 5\,000$	for $L \leqslant 200$		
For $L > 5\,000$	For $L > 200$		
the tolerances shall be defined by agreement between the manufacturer and the user.			1) L is the cross-rail stroke.
0,02	0.000 8		Sub-clauses 5.212.3 and 5.222
for a measuring length of			
1 000	40		Place the table at the mid-position horizontally and the milling head at the mid-position vertically.
For each additional 1 000 mm (40 in) beyond 1 000 mm (40 in), increase this tolerance by			
0,01	0.000 4	Dial gauge support, dial gauge, straightedge or optical means	Fix the dial gauge support and dial gauge on milling head.
Local tolerance:			Orientate straightedge in the transverse direction.
0,015	0.000 6		
over any measuring length of			Place dial gauge stylus in contact with straightedge and move the milling head through the measured length.
500	20		
Maximum permissible deviation:			Read indications.
0,06	0.002 4		

STANDARDSISO.COM : Click to view the full PDF of ISO 8636-1:1987

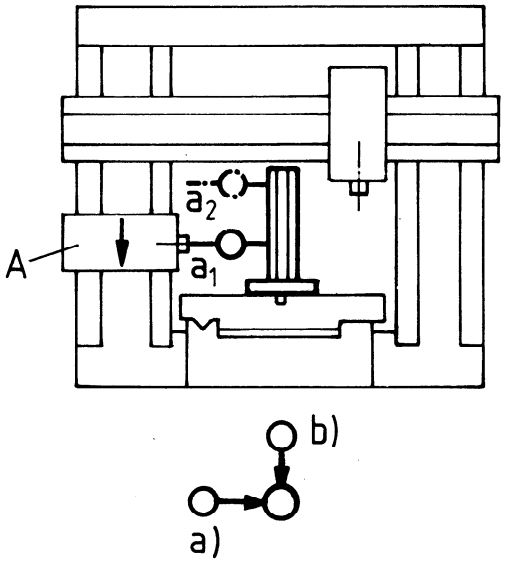
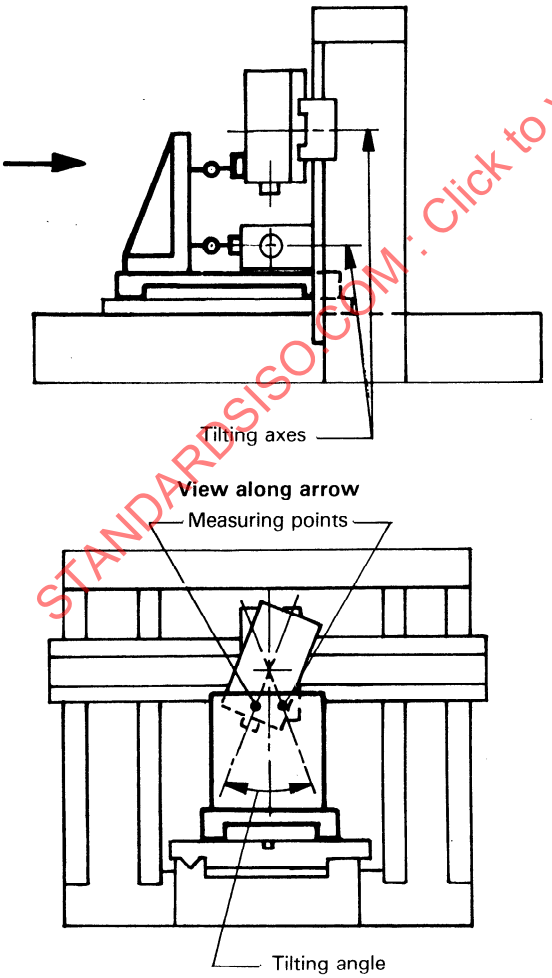
No.	Diagram	Object
G9	a)  b)  	Checking of squareness of milling head quill (ram) vertical movement to the reference plane a) in a longitudinal plane (X axis); b) in a transverse plane (Y axis).
G10		Checking of squareness of milling head transverse movement on cross-rail to table longitudinal movement in the horizontal plane.

STANDARDSISO.COM : Click to view the full PDF of ISO 8636-1:1987

Permissible deviation		Measuring instruments	Observations and references to the ISO 230-1 acceptance code
mm	in		
0,02/300	0.000 8/12	Dial gauge support, dial gauge, cylindrical square and surface plate or straightedge	Sub-clause 5.522.2 Lock table in mid-position. Fix dial gauge support and dial gauge to milling head; lock cross-rail to column. Using a surface plate placed in the centre of the table surface and oriented parallel to the reference surface, position square cylinder, place dial gauge stylus in a longitudinal plane at position a_1 on square cylinder. Move milling head to position a_2 and read indication. Rotate square cylinder 180° and repeat checking in the same sequence. Determine average values of actual deviations. Then carry out checking in a transverse plane at positions b_1 and b_2. For machines of large dimensions, the check may be made in the mid-position and in two extreme positions of the milling head on the cross-rail.
0,02/500 up to a table width of 3 000	0.000 8/20 120	Dial gauge support, dial gauge, square and straightedge	Sub-clause 5.522.4 Table in mid-position of travel. Fix dial gauge support and dial gauge to milling head. Place the square on the table with one side aligned in a longitudinal direction (X axis). Place dial gauge stylus in contact with a straightedge parallel to other side of the square and move milling head by measured length. Then read indication. Rotate square 180° and repeat checking in the same order. Determine average values of actual deviations. If the table width exceeds 1 000 mm (40 in), tests shall be repeated in different positions along the table width.

NOTE — In the case of a table width beyond 3 000 mm (120 in), the permissible deviation is subject to agreement between manufacturer and user.

STANDARDSISO.COM : Click to view the full PDF of ISO 8636-1:1987

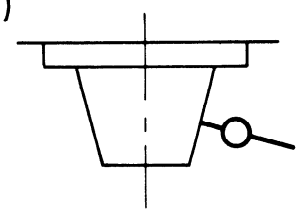
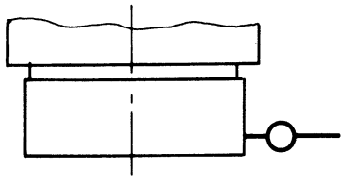
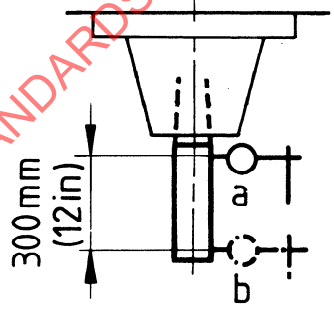
No.	Diagram	Object
G11		Checking of squareness of movement of the milling head, A, on a column, to the reference plane a) in a transverse plane (Y axis); b) in a longitudinal plane (X axis).
G12		For tilting milling heads. Checking of parallelism of milling head tilting axes to reference plane when milling heads swivel. (For tilting axes parallel to longitudinal displacement of table or parallel to transverse displacement of milling head on cross-rail.)

STANDARDSISO.COM : Click to view the full PDF of ISO 8636-1:1987

Permissible deviation		Measuring instruments	Observations and references to the ISO 230-1 acceptance code
mm	in		
a) and b) 0,03/500	0.001 2/20	Dial gauge support, dial gauge, cylindrical square and surface plate	Sub-clause 5.512.2 Fix dial gauge support and dial gauge to milling head. On base plate oriented parallel to reference plane, place cylindrical square. Place dial gauge stylus at position a_1 against cylindrical square, move milling head by the measured length to position a_2 and read indications. Rotate cylindrical square 180° and repeat checking in the same order. Determine average values of actual deviations. The test shall be repeated in a longitudinal plane.
0,02 for α [1] $\leqslant$ 10°	0.000 8	Dial gauge support, dial gauge, square, surface plate and gauge blocks	Sub-clause 5.422.22 Fix dial gauge support to milling head; orientate square parallel to displacement concerned and touch the square face. Place dial gauge at 500 mm (20 in) from milling head tilting axis. Rotate tilting milling head and read indication. Remark: This operation allows a check of parallelism of tilting axes of inclinable milling head to the reference plane of the machine. This plane is defined by the longitudinal displacement of the table and the milling head transverse displacement.
0,03 for $\alpha \leqslant 20°$	0.001 2		
0,04 for $\alpha > 20°$	0.001 6		

1) α is the tilt angle.

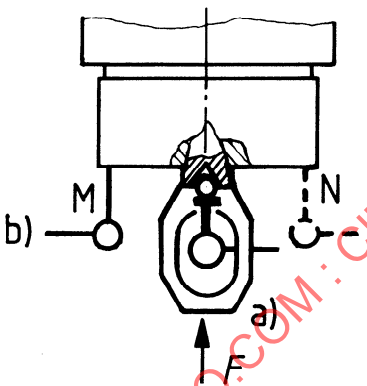
STANDARDSISO.COM : Click to view the full PDF of ISO 8636-1:1987

No.	Diagram	Object
G13	a)  b) 	**E — Milling spindle** Measurement of run-out of external tool housing (milling head) a) cone; b) cylinder.
G14		Measurement of run-out of rotation of internal taper of milling spindle.

STANDARDSISO.COM : Click to view the full PDF of ISO 8636-1:1987

Permissible deviation		Measuring instruments	Observations and references to the ISO 230-1 acceptance code
mm	in		
a) or b) 0,01 for D [1] $\leqslant$ 200 0,015 for D > 200	a) or b) 0.000 4 for D [1] $\leqslant$ 8 0,000 6 for D > 8	Dial gauge support and dial gauge	Sub-clauses 5.612 and 5.612.3 Fix dial gauge support and dial gauge to milling head. Place dial gauge stylus at position a) or b) as appropriate against generator, rotate milling spindle and read indication. Carry out test for each milling spindle in the vertical or horizontal position. 1) D is the external diameter of the tool housing.
a: 0,01 for D [1] $\leqslant$ 200 0,015 for D > 200 b: 0,02 for $D \leqslant$ 200 0,03 for D > 200	a: 0.000 4 for D [1] $\leqslant$ 8 0.000 6 for D > 8 b: 0.000 8 for $D \leqslant$ 8 0.001 2 for D > 8	Dial gauge support, dial gauge and test mandrel	Sub-clauses 5.612 and 5.612.3 Fix dial gauge support and dial gauge to milling head and insert test mandrel. Place dial gauge stylus as close as possible to position **a**, rotate the spindle and read the indication. Repeat the same operation at position **b** over a distance of 300 mm (12 in). Carry out test for each milling spindle of the machine in the vertical or horizontal position. 1) D is the diameter of the tool housing.

STANDARDSISO.COM : Click to view the full PDF of ISO 8636-1:1987

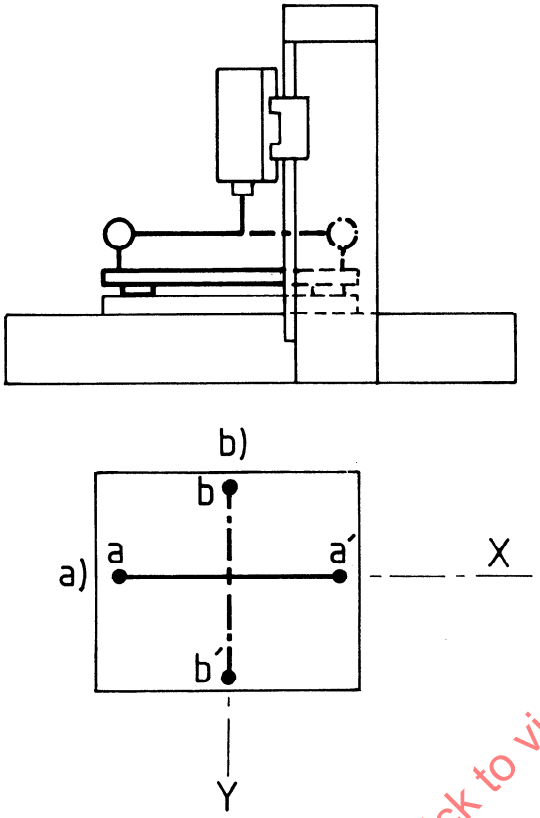
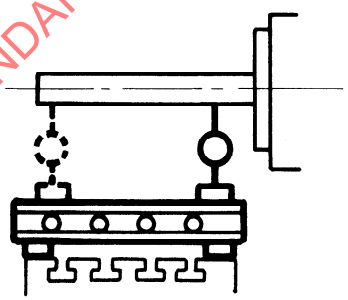
No.	Diagram	Object
G15		a) Measurement of periodic axial slip of milling spindle. b) Measurement of camming of spindle nose face (including periodic axial slip).

STANDARDSISO.COM : Click to view the full PDF of ISO 8636-1:1987

Permissible deviation		Measuring instruments	Observations and references to the ISO 230-1 acceptance code
mm	in		
a)		Dial gauge support, dial gauge or other auxiliary devices	a) Sub-clauses 5.622.1 and 5.622.2 Fix dial gauge support and dial gauge to milling head. Insert a steel ball in spindle centring, by auxiliary means if necessary. Position dial gauge stylus, rotate spindle and read indication. Carry out check on each spindle of the machine. The value and direction of application of force F shall be specified by the manufacturer.
0,01 for D [1] $\leqslant$ 200	0.000 4 for D [1] $\leqslant$ 8		
0,015 for $D > 200$	0.000 6 for $D > 8$		
b)			b) Sub-clause 5.632 Fix dial gauge support and dial gauge to a fixed part of the machine. Place dial gauge stylus as close as possible to outside edge of flat face at position **M**, rotate the spindle and read the indication. Repeat the same operation at position **N** after moving the dial gauge. Determine average value. The value and direction of application of force F shall be specified by the manufacturer.
0,015 for $D \leqslant 200$	0.000 6 for $D \leqslant 8$		
0,02 for $D > 200$	0.000 8 for $D > 8$		

1) D is the external diameter of spindle nose face.

STANDARDSISO.COM : Click to view the full PDF of ISO 8636-1:1987

No.	Diagram	Object
G16		Checking of squareness of vertical milling spindle axis of rotation to the reference plane a) in a longitudinal plane (X axis); b) in a transverse plane (Y axis). (Only for milling heads with vertical axis.)
G17		Checking of parallelism of horizontal milling spindle axis of rotation to the reference plane. (Only for milling heads with horizontal spindle axis, whether the milling head is placed on a column slideway or on the cross-rail.) (This check does not apply to removable milling heads.)

STANDARDSISO.COM : Click to view the full PDF of ISO 8636-1:1987