

Accuracy of machine tools and methods of test —

Part 36: Specification for plano-milling machines, portal type

[ISO title: Acceptance conditions for plano-milling machines — Testing of the accuracy — Part 1: Portal-type machines]

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Committees responsible for this British Standard

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- Advanced Manufacturing Technology Research Institute
- Cranfield Institute of Technology
- Department of Trade and Industry
- Mechanical Engineering and Manufacturing Technology Division (Mmt)
- Health and Safety Executive
- Institution of Production Engineers
- Ministry of Defence
- University of Aston in Birmingham

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National foreword

This Part of BS 4656 has been prepared under the direction of the Machine, Engineers and Hand Tools Standards Committee and implements agreements of the International Organization for Standardization (ISO). It is identical with ISO 8636:1987 “*Acceptance conditions for plano-milling machines — Testing of the accuracy — Part 1: Portal-type machines*”.

Inch dimensions. In accordance with the UK policy of metrication, inch dimensions given in this standard are not valid and are included for information purposes only.

Abbreviations. For the purposes of this standard, various methods of expressing permissible deviations are employed, each having a particular type of application. The methods employed are as follows.

- - -/- - - This type of expression applies to deviations of perpendicularity that are ratios.
- - - for any length of - - - This type of expression applies to deviations of straightness and parallelism, and is used in fact for local permissible deviations, the measurement length being obligatory.
- - - per - - - This type of expression applies to deviations of straightness and parallelism and is used to recommend a measurement length, but in this case the proportionality rule comes into operation if the measurement length differs from that indicated.

Diagrams. For reasons of simplicity the diagrams in this standard illustrate only one type of machine.

Terminology and conventions. The text of the International Standard has been approved as suitable for publication as a British Standard without deviation. Some terminology and certain conventions are not identical with those used in British Standards; attention is drawn especially to the following.

The comma has been used as a decimal marker. In British Standards it is current practice to use a full point on the baseline as the decimal marker.

Wherever the words “this part of ISO 8636” appear, referring to this standard, they should be read as “this Part of BS 4656”.

Cross-reference

International Standard	Corresponding British Standard
ISO 230:1961	BS 3800:1964 <i>Methods for testing the accuracy of machine tools</i> (Technically equivalent)

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 34, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

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 sub-clause **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.

5 Nomenclature and designation of axes

5.1 Nomenclature

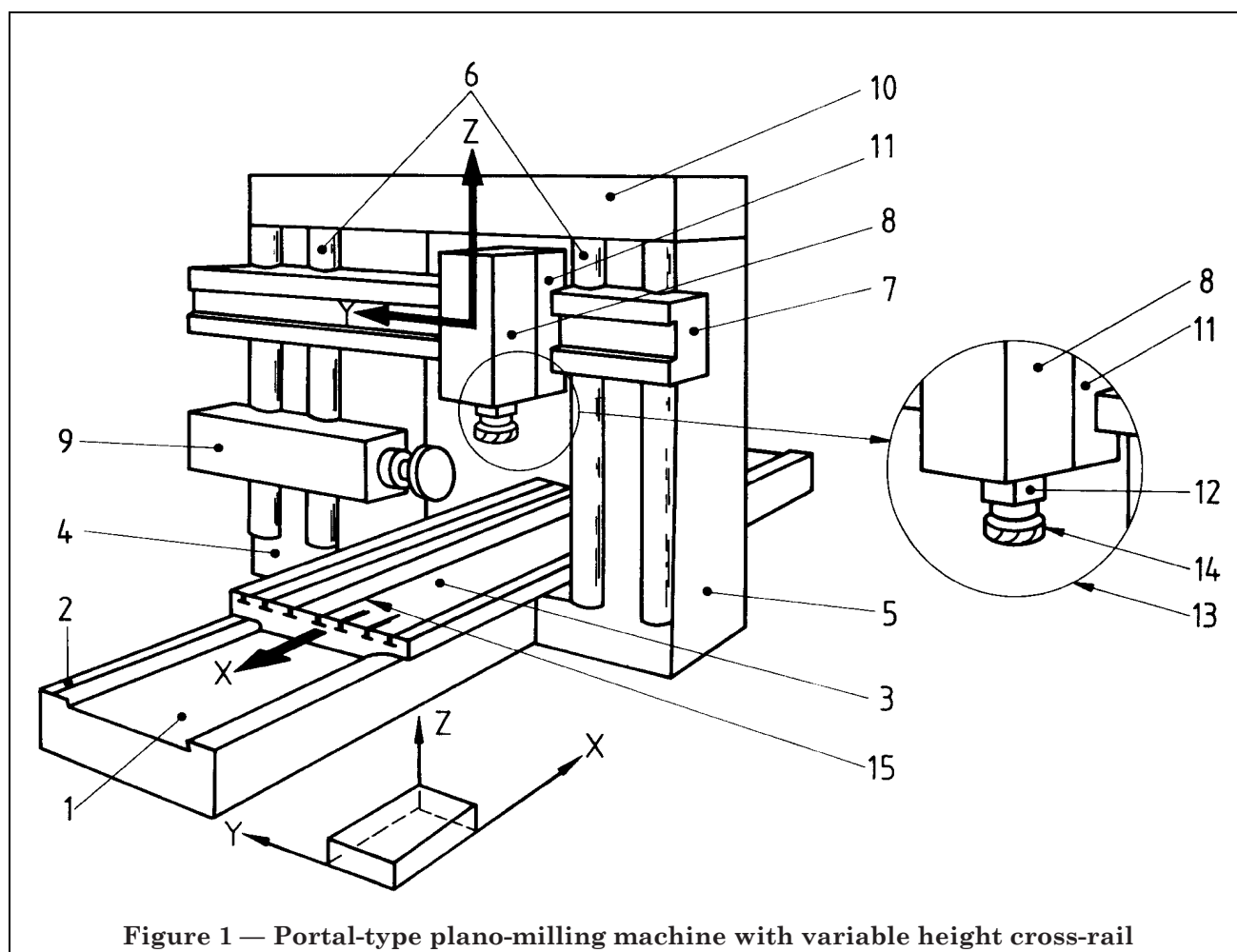
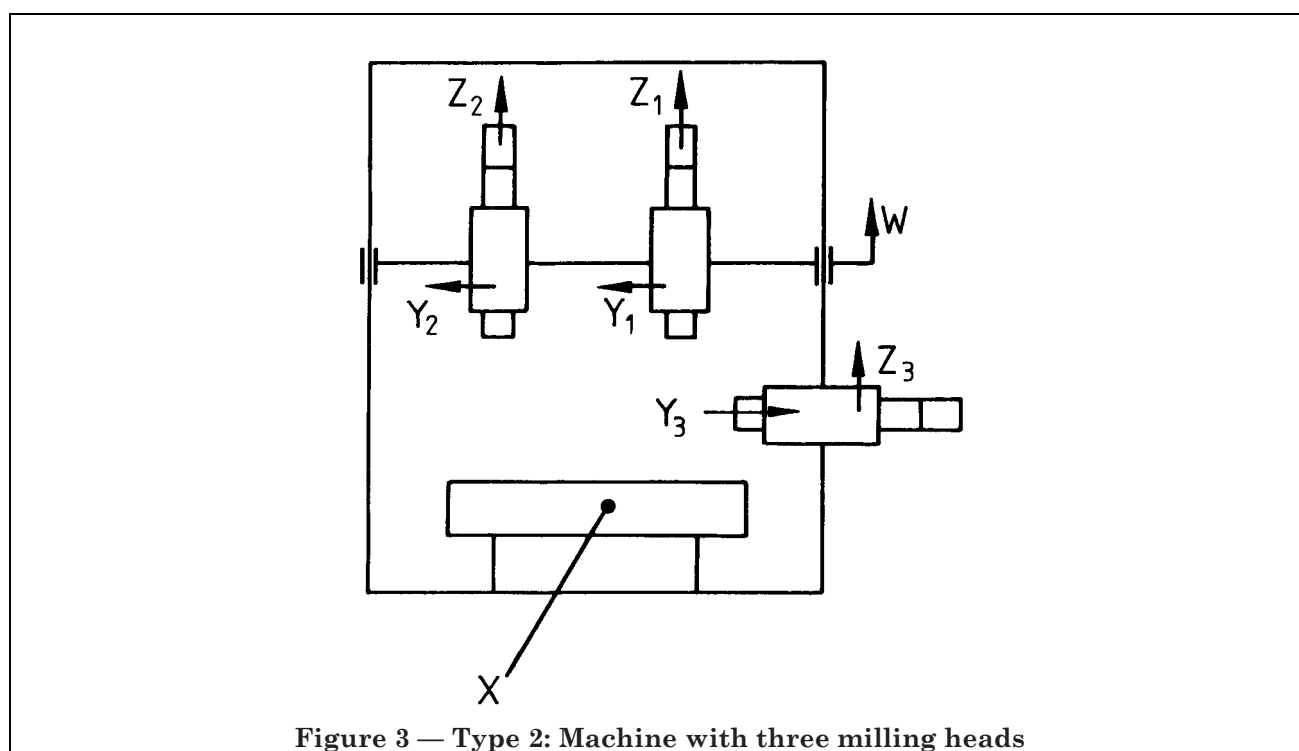
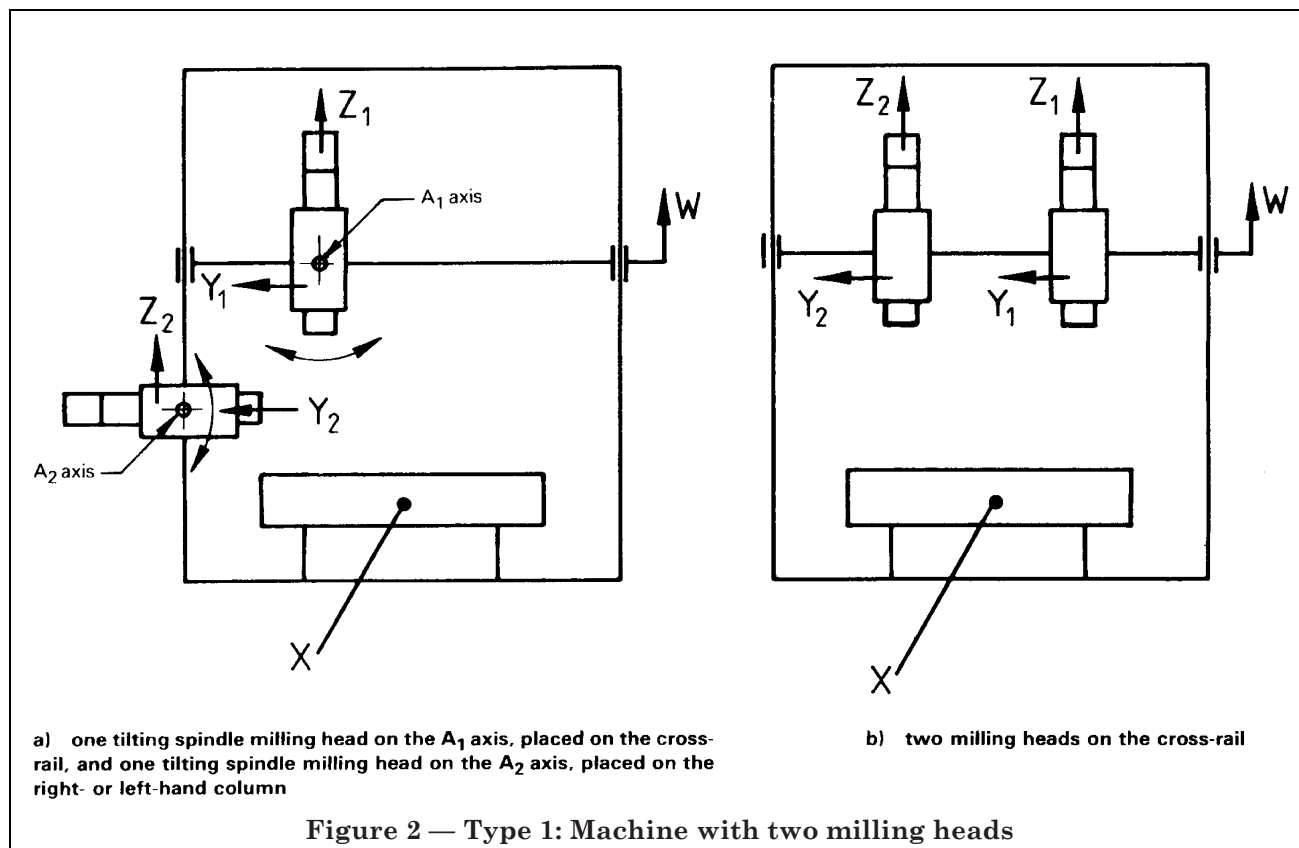


Figure 1 — Portal-type plano-milling machine with variable height cross-rail

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

5.2 Designation of axes



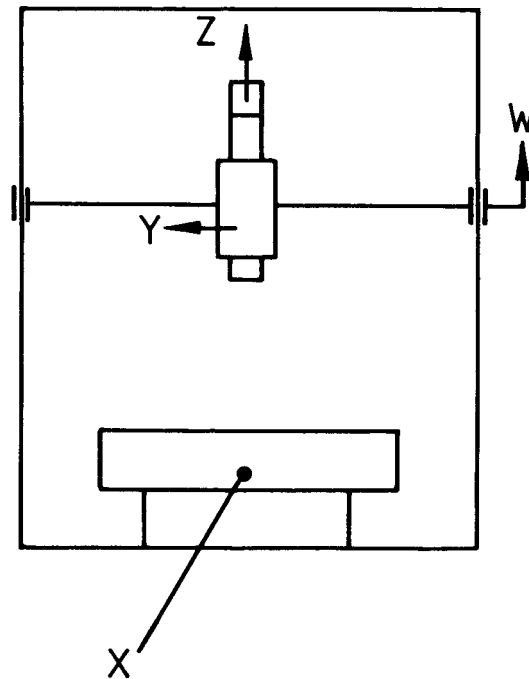


Figure 4 — Type 3: Machine with one milling head on the cross-rail

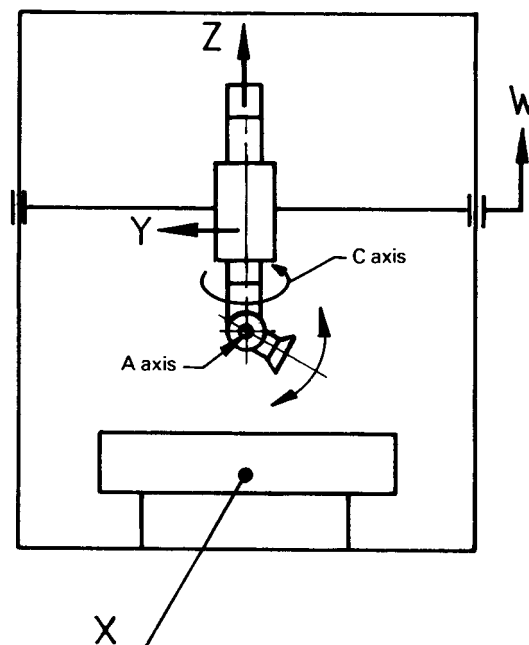


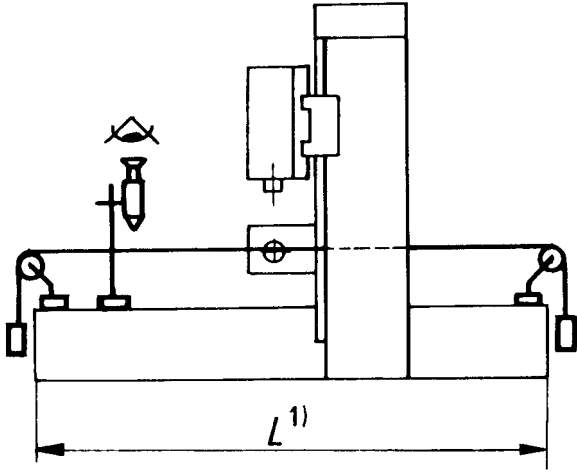
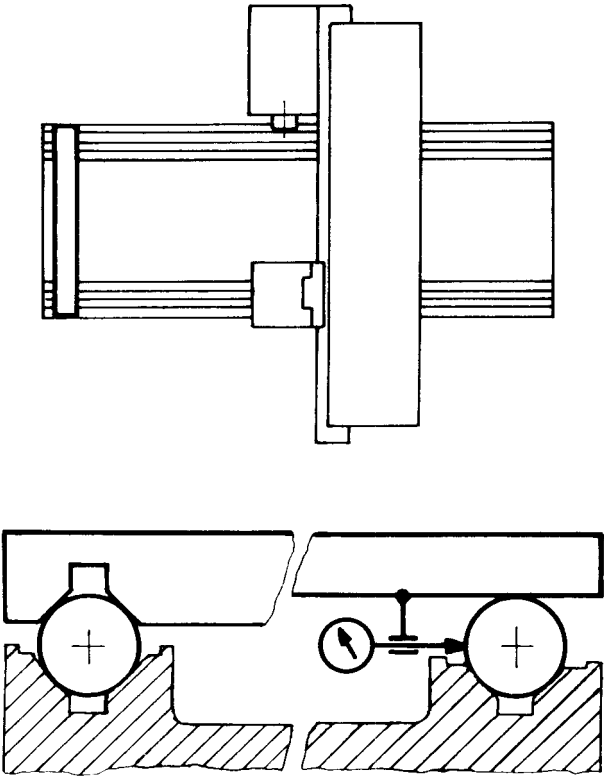
Figure 5 — Type 4: Machine with one milling head on the cross-rail and an additional milling head swivelling on axes C and A

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^a: 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.

Permissible deviation		Measuring instruments	Observations and references to the ISO 230-1 acceptance code
mm	in		
Local tolerance: a) 0,02 0.000 8 over any measured length (flat or convex) of 1 000 40 b) 0,02/1 000 0.000 8/40.		Straightedge, precision levels, special support	Sub-clauses 3.1 and 3.2 Table dismantled. a) Place level in the longitudinal direction on each slideway at a number of equally spaced positions along the bed length. 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. Such checks shall be carried out when mounting the machine. ^a The shape characteristics of the bed basic plane from which the permissible deviation is measured shall be supplied graphically or described by the manufacturer.

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).