
**Machine tools — Test conditions
for bridge-type milling machines —
Testing of the accuracy —**

**Part 2:
Travelling bridge (gantry-type) machines**

*Machines-outils — Conditions d'essai des machines à fraiser
à portique — Contrôle de l'exactitude —
Partie 2: Machines à portique mobile*

ISO 8636-2:2007

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Published in Switzerland

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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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 8636-2 was prepared by Technical Committee ISO/TC 39, *Machine tools*, Subcommittee SC 2, *Test conditions for metal cutting machine tools*.

This second edition cancels and replaces the first edition (ISO 8636-2:1988) which has been technically revised. Especially,

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- a) geometrical tests have been rearranged; the new G numbers compared to the old ones are given in the following table:

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ISO 8636-2:2007	1	2(add)	3	4(add)	5	6	7	8	9	10	11	12
ISO 8636-2:1988	2	—	8	—	10	9	6	5	1	4&7	3	13

ISO 8636-2:2007	13	14	15	16(add)	17	18
ISO 8636-2:1988	12, 14, 15	16	11	—	17	18

- b) information has been added in “Object” boxes for G6, G12, G13, G14 and G15. This information has been added because the machines have several milling heads and the test items are applicable to all of the milling heads;
- c) tolerances on accuracy and repeatability of positioning have been changed in accordance with ISO 230-2:2006;
- d) new test for geometric accuracy of axes of rotation of workholding spindles (R1) has been added.

The actual deviations of all parameters are shown as test results, but the tolerances are limited only to certain parameters.

ISO 8636 consists of the following parts, under the general title *Machine tools — Test conditions for bridge-type milling machines — Testing of the accuracy*:

- Part 1: Fixed bridge (portal-type) machines
- Part 2: Travelling bridge (gantry-type) machines

Machine tools — Test conditions for bridge-type milling machines — Testing of the accuracy —

Part 2: Travelling bridge (gantry-type) machines

1 Scope

This part of ISO 8636 specifies, with reference to ISO 230-1, ISO 230-2, and ISO 230-7, geometric tests, machining tests, and tests for checking accuracy and repeatability of positioning of numerically controlled axes for general-purpose normal accuracy bridge-type milling machines with a travelling bridge (gantry-type). This part of ISO 8636 also specifies the applicable tolerances corresponding to the above-mentioned tests.

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

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

This part of ISO 8636 provides the terminology used for the principal components of the machines and the designation of the axes with reference to ISO 841.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 230-1:1996, *Test code for machine tools — Part 1: Geometric accuracy of machines operating under no-load or finishing conditions*

ISO 230-2:2006, *Test code for machine tools — Part 2: Determination of accuracy and repeatability of positioning numerically controlled axes*

ISO 230-7:2006, *Test code for machine tools — Part 7: Geometric accuracy of axes of rotation*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 milling operation

machining operation, which consists of removing material by means of a rotary tool (milling cutter), of which there are several different types

NOTE Typical milling operations mostly involve face milling or end milling. The tools are mounted either in the spindle taper or on the spindle front face.

3.2 boring operation
operation which consists of machining the diameters of cylindrical, conical, blind or through-holes to the required size

3.3 drilling [tapping] operation
operation to produce blind or through-holes

3.4 travelling bridge (gantry-type) milling machine
milling machine with one fixed workpiece-holding table, two slideways on either side of the table, and a travelling bridge (gantry) on which the milling head(s) are mounted

NOTE 1 The slideways may or may not be independent of the table.

NOTE 2 The gantry, composed of a left-hand column and a right-hand column supported by respective column slides and made integral with a fixed top bridge, is moved along the bed slideways. The gantry supports a horizontal cross-rail, movable or fixed in the vertical plane, on which one or more milling heads are mounted with vertical or inclinable spindles.

4 Classification and description of travelling bridge (gantry-type) milling machines

4.1 Classification

These machines are classified into the following types depending upon construction:

- travelling bridge (gantry-type) milling machines with fixed cross-rail,
- travelling bridge (gantry-type) milling machines with movable cross-rail (see Figure 1).

4.2 Descriptions of principal components

The principal components of these machines are described in Figure 1.

4.2.1 Bed and table

The worktable (1) is located between two slideways that form the bed. The worktable and the slideways can be constructed in one piece. Alternatively, the assembly may be made of several pieces rigidly connected through the foundation or directly to each other.

NOTE The table can be replaced by a floorplate.

4.2.2 Columns, top bridge and cross-rail

The columns (9) and (10) are rigid parts with vertical slideways, which either slide on the bed or are fixed rigidly to column slides (7) and (8) which slide horizontally on the bed.

The top bridge (11) is a fixed part connecting the two columns near their top ends.

The cross-rail (14) is a part whose horizontal slideways are parallel to the plane of the table. In the case of machines with fixed cross-rails, the cross-rail is made integral with the columns and may be used as a top bridge. In the case of machines with movable cross-rails, the cross-rail slides vertically on the slideways of the columns (12) and (13).

One or more milling heads with vertical, horizontal or inclinable spindles are mounted on the cross-rail slideways.

4.2.3 Milling head(s)

Milling heads (16) and (20) are mounted on head saddles (15) and (21) which move on the cross-rail or column slideways.

The portion in direct contact with the cross-rail slideways is called the vertical head saddle (15).

The milling head may be mounted so that it slides on the vertical head saddle in the direction of the spindle axis; it is then called a ram. The spindle may be mounted in a quill sliding in the milling head in the direction of the spindle axis. Some parts of the head may be inclinable.

4.2.4 Cutting motion

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

4.2.5 Feed motion

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

- horizontal movement of the movable gantry;
- vertical movement of the movable cross-rail;
- horizontal movement of the milling heads;
- vertical movement of rams, if any;
- rotational movement (tilt movements of milling heads).

NOTE 1 In general, rapid traverse is available in addition to feed movement.

NOTE 2 The vertical movement of the movable cross-rail can be either a feed movement (in which case the cross-rail is said to be movable when working) or a movement between fixed working positions (the cross-rail is then said to be movable when being positioned).

5 Terminology and designation of axes

5.1 Terminology

See Figure 1 and Table 1.

5.2 Designation of axes

See Figures 1 to 4.

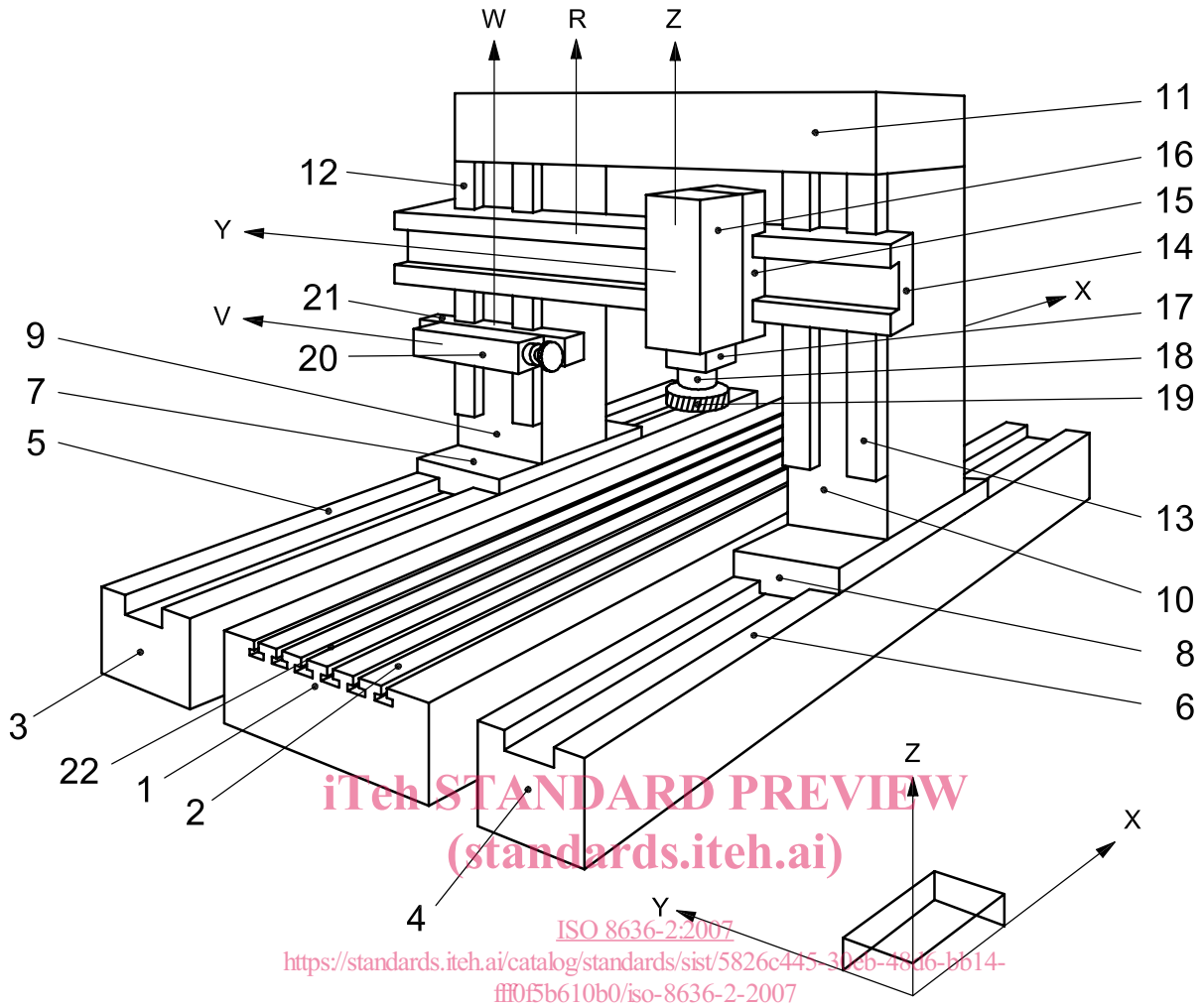


Figure 1 — Travelling bridge (gantry-type) machine with movable cross-rail (see Table 1)

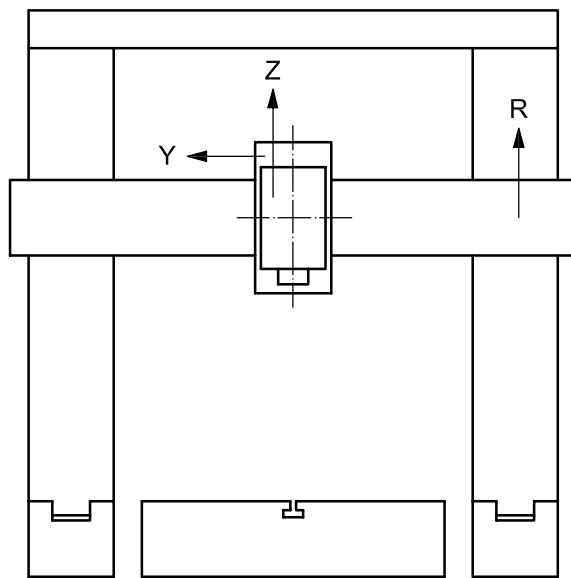


Figure 2 — Machine with one milling head

Table 1 — Terminology

Ref.	English	French	German
1	Table (or floorplate)	Table (ou taque)	Tisch (oder Bodenplatte)
2	Clamping surface	Surface de bridage	Aufspannfläche
3	Left-hand part of the bed	Banc gauche	Linker Teil des Maschinenbetts
4	Right-hand part of the bed	Banc droit	Rechter Teil des Maschinenbetts
5	Left-hand bed slideways	Glissières du banc gauche	Linke Bett-Führungsbahnen
6	Right-hand bed slideways	Glissières du banc droit	Rechte Bett-Führungsbahnen
7	Left-hand column slide	Chariot porte-montant gauche	Linker Ständerschlitzen
8	Right-hand column slide	Chariot porte-montant droit	Rechter Ständerschlitzen
9	Left-hand column	Montant gauche	Linker Ständer
10	Right-hand column	Montant droit	Rechter Ständer
11	Top bridge	Entretoise	Querbalken
12	Left-hand column slideways	Glissières du montant gauche	Linke Ständer-Führungsbahnen
13	Right-hand column slideways	Glissières du montant droit	Rechte Ständer-Führungsbahnen
14	Cross-rail (movable or fixed)	Traverse (mobile ou fixe)	Traverse (beweglich oder fest)
15	Vertical head saddle	Chariot porte-outils vertical	Senkrechter Spindelstockschlitten
16	Vertical milling head	Tête de fraisage verticale	Senkrechter Fräskopf
17	Quill (ram)	Fourreau (coulant)	Traghülse (Pinole)
18	Milling spindle	Broche porte-fraise	Frässpindel
19	Tool (milling cutter)	Outil (fraise)	Werkzeug (Fräser)
20	Horizontal milling head	Tête de fraisage horizontale	Waagerechter Fräskopf
21	Horizontal head saddle	Chariot porte-outils horizontal	Waagerechter Spindelstockschlitten
22	Reference T-slot	Rainure à T de référence	Referenz T-Nut

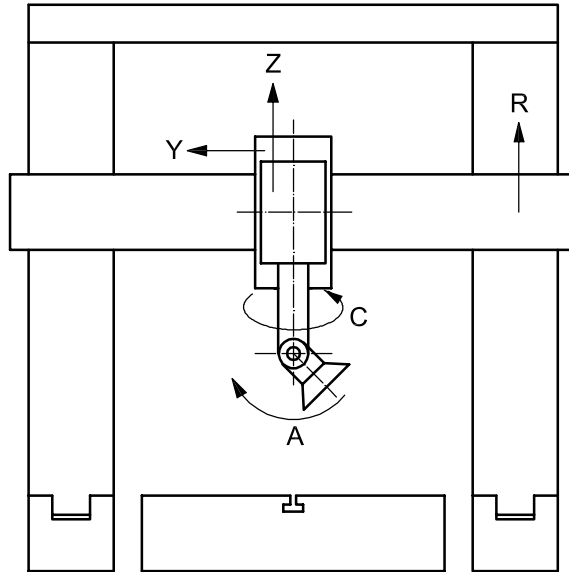


Figure 3 — Machine with one milling head swivelling on axes C and A

6 Preliminary remarks

6.1 Measuring units

In this part of ISO 8636, all linear dimensions, deviations and corresponding tolerances are expressed in millimetres; angular dimensions are expressed in degrees, and angular deviations and the corresponding tolerances are primarily expressed in ratios (e.g. 0,00x/1 000), but in some cases microradians (μrad) or arcseconds ($''$) may be used for clarification purposes. The equivalence of the following expressions should always be kept in mind:

$$0,010/1\ 000 = 10\ \mu\text{rad} \approx 2''$$

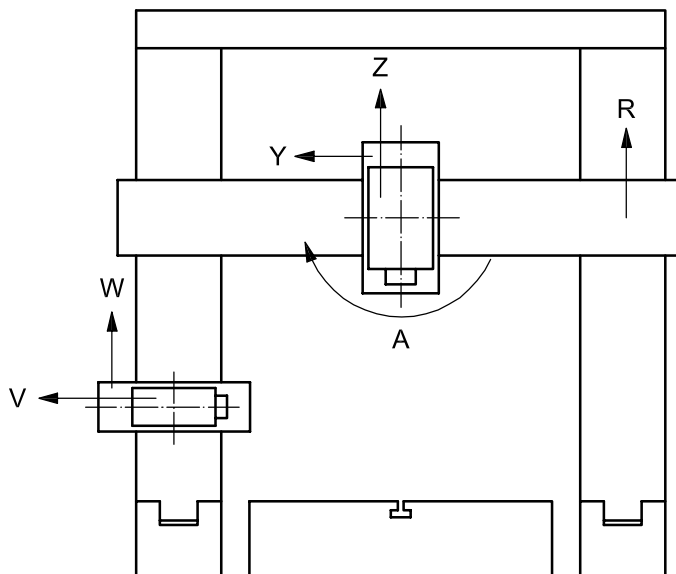
6.2 Reference to ISO 230-1, ISO 230-2, and ISO 230-7

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

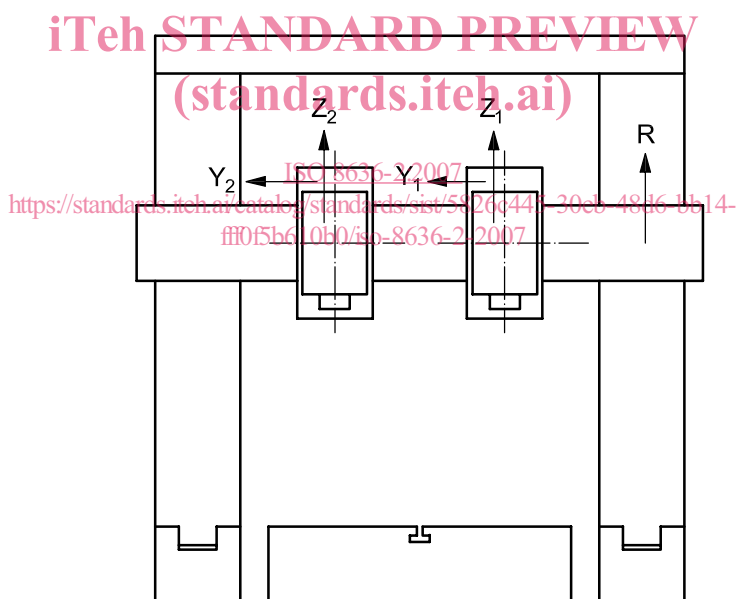
In the “Observations” box of the tests described in the following clauses, the instructions are preceded by a reference to the corresponding clause in ISO 230-1, ISO 230-2 or ISO 230-7 in cases where the test concerned is in compliance with the specifications of one of those parts of ISO 230.

6.3 Temperature conditions

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



a) One swivelling (A-axis) milling head mounted on the cross-rail and one horizontal milling head mounted on the right- or left-hand column



b) Two vertical milling heads mounted on the cross-rail

Figure 4 — Machine with two milling heads (two examples)

6.4 Testing sequence

The sequence in which the tests are presented in this part of ISO 8636 in no way defines the practical order of testing. In order to facilitate the mounting of instruments or gauging, tests may be performed in any order.

6.5 Tests to be performed

When testing a machine, it is not always necessary or possible to carry out all the tests described in this part of ISO 8636. If the tests are required for acceptance purposes, it is the responsibility of the user to choose, in agreement with the supplier/manufacturer, those tests relating to the components and/or the properties of the machine which are of interest. These tests shall be clearly stated when ordering a machine. Mere reference to this part of ISO 8636 for the acceptance tests, without specifying the tests to be carried out, and without agreement on the relevant expenses, cannot be considered as binding for any contracting party.

6.6 Measuring instruments

The measuring instruments indicated in the tests described in the following clauses are examples only. Other instruments measuring the same quantities and having no larger measurement uncertainty may be used.

6.7 Minimum tolerance

When establishing the tolerance for a measuring length different from that given in this part of ISO 8636 (see 2.311 of ISO 230-1:1996), it shall be taken into consideration that the minimum value of tolerance is 0,005 mm.

6.8 Machining tests

Machining tests shall be made with finishing cuts only. Roughing cuts shall be avoided since they are liable to generate appreciable cutting forces.

6.9 Positioning tests

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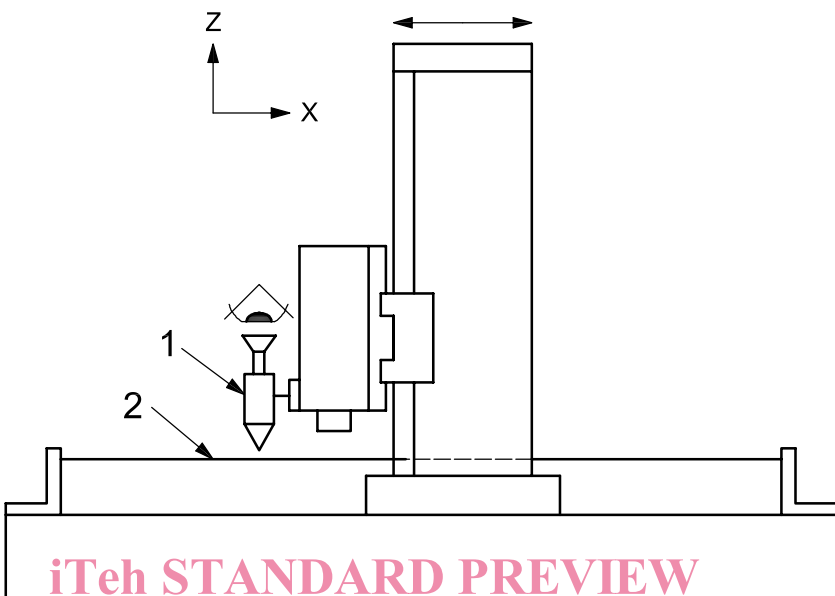
Positioning tests for numerically controlled machines shall refer to ISO 230-2. Tolerances in this part of ISO 8636 are given only for some parameters. The presentation of the test results shall be in compliance with ISO 230-2.

7 Geometric tests

Tolerances are limited to the machines of table size up to 3 000 mm × 10 000 mm. For machines greater than this length or width, the tolerance shall be agreed upon between the supplier/manufacturer and user.

Place the gantry at mid-stroke, with milling head at mid-position on cross-rail (or in symmetrical positions if several heads are available).

7.1 Axes of motion

<p>Object</p>	<p>G1</p>
<p>Checking of straightness of movement of the column (X-axis) in the horizontal X-Y plane (EYX).</p>	
<p>Diagram</p>  <p style="text-align: center; color: red; font-weight: bold;">iTeh STANDARD PREVIEW (standards.iteh.ai)</p>	
<p>Key</p> <p>1 microscope 2 taut wire</p> <p style="text-align: center; color: red;">ISO 8636-2:2007 https://standards.iteh.ai/catalog/standards/sist/5826c445-30eb-48d6-bb14-f10f5b610b0/iso-8636-2-2007</p>	
<p>Tolerance</p> <p>0,02 for measuring length up to 2 000 Add 0,01 to the preceding tolerance for each 1 000 increase in length beyond 2 000 Maximum tolerance: 0,10 Local tolerance: 0,01 for any measuring length of 1 000</p>	<p>Measured deviation</p>
<p>Measuring instruments</p> <p>Microscope/CCD camera and taut wire or other methods.</p>	
<p>Observations and references to ISO 230-1:1996, 5.232.12, 5.232.13 and 5.232.14</p> <p>When using microscope/CCD camera and taut wire, the microscope/CCD camera shall be mounted on the head, and the taut wire shall be fixed to each end of the table parallel to X-axis movement of the column (readings of the microscope/CCD camera at both ends of the movement should be the same. In this case, the maximum difference of the readings gives the straightness deviation). Traverse the column in the X-direction and record the readings.</p>	