
**Test conditions for milling machines
with table of variable height — Testing
of accuracy —**

**Part 2:
Machines with horizontal spindle**

*Conditions d'essai des machines à fraiser à table de hauteur variable —
Contrôle de la précision —*

Partie 2: Machines à broche horizontale



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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.

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.

International Standard ISO 1701-2 was prepared by Technical Committee ISO/TC 39, *Machine tools*, Subcommittee SC 2, *Test conditions for metal cutting machine tools*.

This first edition of ISO 1701-2 as well as ISO 1701-3 cancels and replaces ISO 1701:1974, which has been technically revised.

ISO 1701 consists of the following parts, under the general title *Test conditions for milling machines with table of variable height — Testing of accuracy*:

- *Part 0: General introduction (to become part 1 on its next revision)*
- *Part 2: Machines with horizontal spindle*
- *Part 3: Machines with vertical spindle*

Annex A of this part of ISO 1701 is for information only.

Introduction

The purpose of ISO 1701 is to standardize methods of testing the accuracy of milling machines with table of variable height, with horizontal or vertical spindle.

Test conditions for milling machines with table of variable height — Testing of the accuracy

Part 2:

Machines with horizontal spindle

1 Scope

This part of ISO 1701 specifies, with reference to ISO 230-1, both geometric and machining tests on general purpose, normal accuracy, horizontal spindle milling machines with table of variable height. It also specifies the applicable tolerances corresponding to the above-mentioned tests.

This part of ISO 1701 deals only with the verification of accuracy of the machine. It does not apply to the testing of the running of the machine (vibration, abnormal noise, stick-slip motion of components, etc.), nor to machine characteristics (such as speeds, feeds, etc.), as such checks are generally carried out before testing the accuracy.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 1701. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 1701 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

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

ISO 1701-0:1984¹⁾, *Test conditions for milling machines with table of variable height — Testing of the accuracy — Part 0: General introduction*.

3 Terminology and designation of axes

For axes of machines with horizontal spindle, reference should be made to 4.1 and figure 4 of ISO 1701-0:1984.

1) See "Foreword".

4 Preliminary remarks

4.1 Measuring units

In this part of ISO 1701 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 in principle expressed in ratios but in some cases micro-radians or arcseconds may be used for clarification purposes. The equivalence of the following expressions should always be kept in mind:

$$0,010/1\ 000 = 10 \times 10^{-6} = 10\ \mu\text{rad} \approx 2''$$

4.2 Reference to ISO 230-1

To apply this part of ISO 1701, 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" block of the tests described in the following sections, the instructions are followed by a reference to the corresponding clause in ISO 230-1 in cases where the test concerned is in compliance with the specifications of that part of ISO 230.

4.3 Testing sequence

The sequence in which the tests are presented in this part of ISO 1701 in no way defines the practical order of testing. In order to make the mounting of instruments or gauging easier, tests may be performed in any order.

4.4 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 1701. When the tests are required for acceptance purposes, it is up to 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 are to be clearly stated when ordering a machine. Mere reference to this part of ISO 1701 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.

4.5 Measuring instruments

The measuring instruments indicated in the tests described in the following sections are examples only. Other instruments measuring the same quantities and having at least the same accuracy may be used. Dial gauges shall have a resolution of 0,001 millimeters or better.

4.6 Machining tests

Machining tests shall be made with finishing cuts only, not with roughing cuts which are liable to generate appreciable cutting forces.

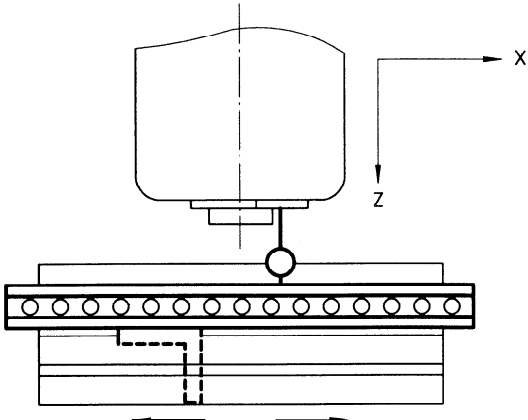
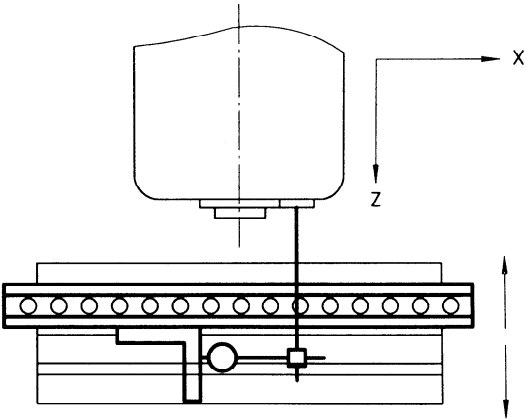
4.7 Minimum tolerance

When the tolerance for a geometric test is established for a measuring length different from that given in this part of ISO 1701 (see 2.311 of ISO 230-1), it shall be taken into consideration that the minimum value of tolerance is 0,005 mm.

5 Geometric tests

5.1 Axes of motion

Object Checking of straightness of the vertical movement of the knee (Y axis): a) in the vertical plane of symmetry of the machine (YZ plane); b) in the plane perpendicular to the vertical plane of symmetry of the machine (XY plane).	G1
Diagram 	
Tolerance For a) and b) 0,020 for any measuring length of 300	(Measured deviation)
Measuring instruments Dial gauge and square	
Observations and references to ISO 230-1 5.232.11 Instead of a straightedge, use the vertical arm of the square. Adjust the square to obtain similar readings at both ends of its measuring length so that straightness deviation can be calculated as the maximum difference of dial gauge readings. Table in central position: a) cross slide (Z axis) locked; b) table (X axis) locked. 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 a fixed part of the machine.	

Object	G2
Checking of squareness between the transverse cross slide movement (Z axis) and the longitudinal table movement (X axis).	
Diagram  a)  b)	
Tolerance 0,02 for a measuring length of 300	(Measured deviation)
Measuring instruments Straightedge, dial gauge and square	
Observations and references to ISO 230-1 5.522.4 Knee (Y axis) locked. a) The straightedge shall be set parallel to the longitudinal table movement (X axis); then the square shall be placed against the straightedge. The table shall then be locked in central position. This test can be performed as well without the straightedge, aligning the long arm of the square parallel to the X axis. b) The transverse cross slide movement (Z axis) shall then be checked. If the spindle can be locked, then the dial gauge may be mounted on it. If the spindle cannot be locked, the dial gauge shall be placed on a fixed part of the machine.	