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Machine tools — Test conditions for surface grinding machines with vertical grinding wheel spindle and reciprocating table — Testing of the accuracy

Machines-outils — Conditions d'essai des machines à rectifier les surfaces planes, à broche porte-meule à axe vertical et à table à mouvement alternatif — Contrôle de l'exactitude

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT), see the following URL: Foreword — Supplementary information.

The committee responsible for this document is ISO/TC 39, *Machine Tools*, Subcommittee SC 2, *Test Conditions for Metal Cutting Machine Tools.*

This fourth edition cancels and replaces the third edition (ISO 1985:1998), which has been technically revised.

Introduction

The purpose of this International Standard is to standardize methods of testing the accuracy of general purpose and normal accuracy surface grinding machines with vertical grinding wheel spindle and reciprocating table.

The primary function of such machines is to provide flat surfaces on workpieces. This International Standard specifies the tests to verify the geometric accuracy of the machine to achieve this primary function. For example, the test to check the straightness of the column movement (Y-axis) in the horizontal XY-plane (E_{XY}) is removed from ISO 1985:1998, since it is not directly correlated to this primary function.

Positioning repeatability test for automatic mode (Not NC) is introduced. References to ISO 230-1 are revised and referred to 2012 edition.

Machine tools — Test conditions for surface grinding machines with vertical grinding wheel spindle and reciprocating table — Testing of the accuracy

1 Scope

This International Standard specifies, with reference to ISO 230-1 and ISO 230-7, both geometric and machining tests on general purpose, normal accuracy, manually, and numerically controlled (NC) surface grinding machines with reciprocating table and vertical grinding wheel spindle. It also specifies the applicable tolerances corresponding to the above-mentioned tests.

This International Standard is not applicable to surface grinding machines with fixed or rotating tables or to machines having longitudinal traverse of the wheelhead.

This International Standard deals only with the verification of the geometric accuracy of the machine. It does not apply to the testing of the machine operation (vibrations, abnormal noises, stick-slip motion of components, etc.), nor to the checking of its characteristics (such as speeds, feeds, etc.), which should generally be checked before testing the accuracy. This International Standard provides the terminology used for the principal components of the machine and the designation of the axes with reference to ISO 841:2001.

NOTE In addition to the terms used in the official ISO languages (English and French), this International Standard gives the equivalent terms in the German, Italian, Persian, and Japanese languages in Annex B; these are published under the responsibility of the national member bodies for Germany (DIN), Italy (UNI), Iran (ISIRI), and Japan (JISC). However, only the terms given in the official language can be considered as ISO terms.

2 Normative references

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

ISO 230-1:2012, *Test code for machine tools — Part 1: Geometric accuracy of machines operating under no-load or quasi-static conditions*

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

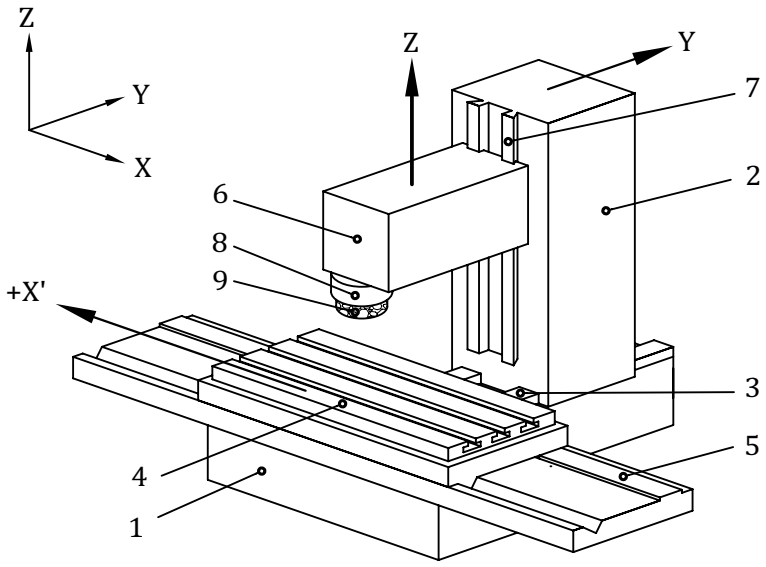
ISO 230-7:—[1)], *Test code for machine tools — Part 7: Geometric accuracy of axes of rotation*

3 Terminology and designation of axes

See Figure 1 and Table 1.

NOTE Some machines do not have the Y-axis.

1) To be published.



NOTE See Table 1 for key reference.

Figure 1 — Typical example of a surface grinding machine with a vertical grinding wheel spindle and a reciprocating table

Table 1 — Terminology

Ref.	English	French
1	bed	banc
2	column (Y-axis)	colonne (axe Y)
3	column slideways	glissières de la colonne
4	table (X-axis)	table (axe X)
5	table slideways	glissières de la table
6	wheelhead (Z-axis)	chariot porte-meule (axe Z)
7	wheelhead slideways	glissières du chariot porte-meule
8	wheel guard	protecteur de meule
9	grinding wheel	meule

4 Preliminary remarks

4.1 Measurement units

In this International Standard, all linear dimensions, deviations, and corresponding tolerances are expressed in millimetres; angular dimensions are expressed in degrees; angular deviations and the corresponding tolerances are expressed primarily in ratios, but in some cases, microradians or arcseconds can be used for clarification purposes. Formula (1) should be used for conversion of angular or tolerances.

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

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

For application of this International Standard, reference shall be made to ISO 230-1 and to ISO 230-7, especially for the installation of the machine before testing, warming up of the spindles and other moving parts, the description of measuring methods, and recommended accuracy of testing equipment.

In the "Observations" block of tests described in Clause 5, the instructions are preceded by a reference to the corresponding clause/subclause in ISO 230-1 in cases where the test concerned is in compliance with the specifications. Similarly, for tests described in Annex A, the instructions are preceded by a reference to the corresponding clause/subclause in ISO 230-2 and ISO 230-7, respectively. Tolerances are given for each geometric test (see G1 to G12).

4.3 Machine levelling

Prior to conducting tests on a machine, the machine should be levelled according to the recommendations of the manufacturer/supplier (see ISO 230-1:2012, 6.1.2).

4.4 Testing sequence

The sequence in which the geometrics tests are given in no way defines the practical order of testing. In order to make the mounting of instruments or gauging easier, tests can be performed in any order.

4.5 Tests to be performed

When testing a machine, it is not always necessary or possible to carry out all the tests given in this International Standard. When the tests are required for acceptance purposes, the choice of tests relating to the components and/or the properties of the machine of interest is at the discretion of the user, in agreement with the manufacturer/supplier. The tests to be used are to be clearly stated when ordering a machine. A mere reference to this International Standard 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 parties.

4.6 Measuring instruments

The measuring instruments indicated in the tests described in Clause 5 are examples only. Other instruments measuring the same quantities and having the same or smaller measurement uncertainty can be used. Reference shall be made to ISO 230-1:2012, Clause 5, which indicates the relationship between measurement uncertainties and the tolerances.

4.7 Diagrams

For reasons of simplification, the figures in Clause 5 and Annex A illustrate only one type of machine.

4.8 Software compensation

When built-in software facilities are available for compensating geometric, positioning contouring and/or thermal deviations, their use during these tests shall be based on agreement between the manufacturer/supplier and user, with due consideration to the machine tool intended use.

When the software compensation is used, this shall be stated in the test reports.

It shall be noted that when software compensation is used, axes shall not be locked for test purposes.

4.9 Minimum tolerance

When the tolerance for a geometric test is established for a measuring length different from that given in this International Standard, the tolerance can be determined by means of the law of proportionality (see ISO 230-1:2012, 4.1.2). It shall be taken into consideration that the minimum value of tolerance is 0,005 mm.

4.10 Machining test

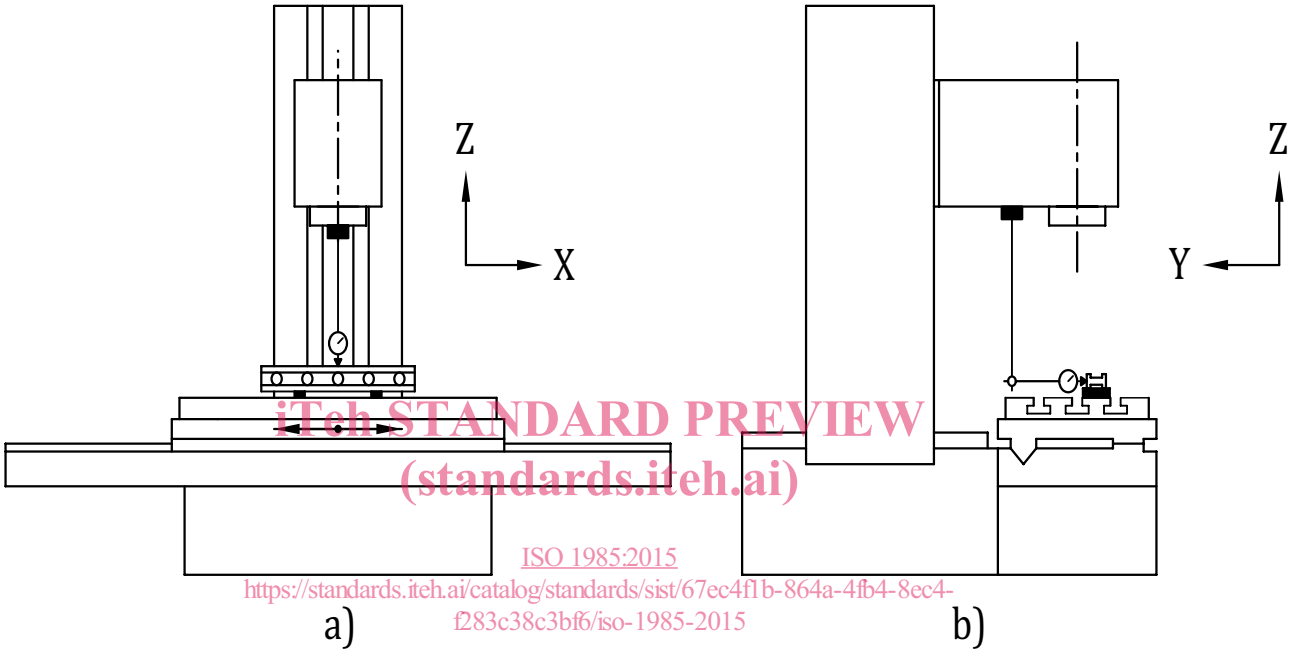
Machining tests shall be made under finishing conditions.

5 Geometric tests

5.1 Linear axes

Object	**G1**
Checking of straightness of the table movement (X-axis) a) in the vertical ZX-plane (E_{ZX}), and b) in the horizontal XY-plane (E_{YX}).	

Diagram



Tolerance	**Measured deviations**
For a) and b) 0,01 for measuring lengths up to 1 000 For each 1 000 increase in length, add 0,01 to the preceding tolerance Maximum tolerance: 0,025	a) b)

Measuring instruments

Straightness reference artefact, gauge blocks, and linear displacement sensor

Observations and references to ISO 230-1:2012, 3.4.8, 8.2.2.1, and 8.2.3

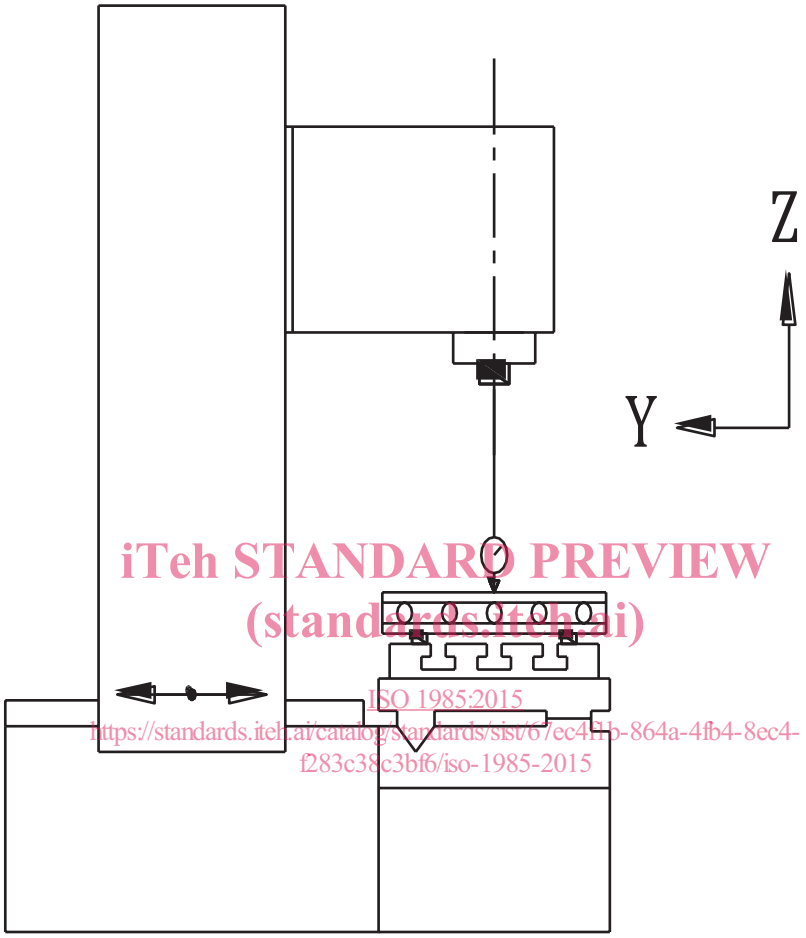
Mount the linear displacement sensor on the head, near the spindle.

Adjust the straightness reference artefact to obtain similar readings at each end of the measuring length.

Feed the X-axis through the measuring length and record the sensor readings.

NOTE The fixture of the straightness reference artefact can affect the test result.

Object	**G2**
Checking of straightness of the column movement (Y-axis) in the horizontal ZY-plane (E_{ZY}) (Only for machines having this movement)	
Diagram	



Tolerance	**Measured deviations**
0,01 for measuring lengths up to 1 000 For each 1 000 increase in length, add 0,01 to the preceding tolerance Maximum tolerance: 0,025	
Measuring instruments Straightness reference artefact, gauge blocks, and linear displacement sensor	
Observations and references to ISO 230-1:2012, 3.4.8, 8.2.2.1, and 8.2.3 Mount the linear displacement sensor on the head, near the spindle. Adjust the straightness reference artefact to obtain similar readings at each end of the measuring length. Feed the Y-axis through the measuring length and record the sensor readings.	