INTERNATIONAL STANDARD

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Test code for machine tools —

Part 2:

Determination of accuracy and repeatability of positioning numerically controlled axes

Code d'essai des machines-outils —

Partie 2: Détermination de l'exactitude et de la répétabilité de positionnement des axes en commande numérique



Reference number ISO 230-2:2006(E)

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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 230-2 was prepared by Technical Committee ISO/TC 39, *Machine tools*, Subcommittee SC 2, *Test conditions for metal cutting machine tools*.

This third edition cancels and replaces the second edition (ISO 230-2:1997), which has been technically revised. In particular, the following modifications have been made:

- a measurement uncertainty statement requirement has been added to the presentation of results (Clause 7);
- determination of measurement uncertainty is included as a new Annex A;
- some editorial changes have been made in the body of the doctorent, mainly to the Introduction;
- ISO 230-2:1997/Cor 1:1999 has been incorporated as 2.23.

ISO 230 consists of the following parts, under the general title *Test code for machine tools*:

- Part 1: Geometric accuracy of machines operating under no-load or finishing conditions
- Part 2: Determination of accuracy and repeatability of positioning numerically controlled axes
- Part 3: Determination of thermal effects
- Part 4: Circular tests for numerically controlled machine tools
- Part 5: Determination of the noise emission
- Part 6: Determination of positioning accuracy on body and face diagonals (Diagonal displacement tests)
- Part 7: Geometric Accuracy of axes of rotation
- Part 9: Estimation of measurement uncertainty for machine tool tests according to series 230, basic equations [Technical Report]

The following parts are under preparation:

— Part 8: Determination of vibration levels [Technical Report]

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Introduction

The purpose of ISO 230 is to standardize methods for testing the accuracy of machine tools, excluding portable power tools.

This part of ISO 230 specifies test procedures used to determine the accuracy and repeatability of positioning numerically controlled axes. The tests are designed to measure the relative displacements between the component that holds the tool and the component that holds the workpiece.

Since measurement uncertainty needs to be stated with the measurement results, a description of the estimation of the measurement uncertainty for the determination of the accuracy and repeatability of positioning has been added as Anex A.

It is believed that, with this addition, the relevant contributors to the measurement uncertainty are able to be recognized more easily and reduced more efficiently.

The supplier/manufacturer should provide thermal specifications for the environment in which the machine can be expected to perform with the specified accuracy. The machine user is responsible for providing a suitable test environment by meeting the supplier/manufacturer's thermal guidelines or otherwise accepting reduced performance. An example of environmental thermal guidelines is given in ISO 230-3:—^[1], Annex C.

C

A relaxation of accuracy expectations is required if the thermal environment causes excessive uncertainty or variation in the machine tool performance and does not meet the supplier/manufacturer's thermal guidelines. If the machine does not meet performance specifications, the analysis of the uncertainty due to the compensation of the machine tool temperature, given in A24 of this part of ISO 230, and the uncertainty due to the environmental variation error, given in A.2.5, can help in identifying sources of problems.



Test code for machine tools —

Part 2:

Determination of accuracy and repeatability of positioning numerically controlled axes

Inis

1 Scope

This part of ISO 230 specifies methods for testing and evaluating the accuracy and repeatability of the positioning of numerically controlled machine tool axes by direct measurement of individual axes on the machine. These methods apply equally to linear and rotary axes.

When several axes are simultaneously under test, the methods do not apply.

This part of ISO 230 can be used for type testing, acceptance tests, comparison testing, periodic verification, machine compensation, etc.

The methods involve repeat measurements at each position. The related parameters of the test are defined and calculated. Their uncertainties are estimated as described in ISO/TR 230-9:2005, Annex C ^[2].

Annex A presents the estimation of the measurement uncertainty.

Annex B describes the application of an optional test cycle — the step cycle. The results from this cycle are not to be used either in the technical literature with reference to this part of ISO 230, nor for acceptance purposes, except under special written agreements between supplier/manufacturer and user. Correct reference to this part of ISO 230 for machine acceptance always refers to the standard test cycle.

2 Terms and definitions

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

2.1

axis travel

maximum travel, linear or rotary, over which the moving component can move under numerical control

NOTE For rotary axes exceeding 360°, there may not be a clearly defined maximum ength of travel.

2.2

measurement travel

part of the axis travel, used for data capture, selected so that the first and the last target positions can be approached bi-directionally

See Figure 1.

2.3

target position

 $P_i (i = 1 \text{ to } m)$

position to which the moving part is programmed to move

NOTE The subscript *i* identifies the particular position among other selected target positions along or around the axis.