
Test code for machine tools —

Part 4:

**Circular tests for numerically controlled
machine tools**

Code d'essai des machines-outils —

*Partie 4: Essais de circularité des machines-outils à commande
numérique*



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Contents

Page

Foreword	iv
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Test conditions	4
4.1 Test environment	4
4.2 Machine to be tested	4
4.3 Machine warm-up	4
4.4 Test parameters	5
4.5 Test instrument calibration	5
4.6 Test uncertainty	5
5 Test procedure	6
6 Presentation of results	6
7 Points to be agreed between supplier/manufacturer and user	6
Annex A (informative) Differences between circular deviations G and $G(b)$ and radial deviations F and D	9
Annex B (informative) Influences of typical machine deviations on circular paths	10
Annex C (informative) Adjustment of diameter and contouring feed	15
Annex D (informative) Circular tests using feedback signal	16
Bibliography	17

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 230-4 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 230-4:1996), of which it constitutes a technical revision. The main changes are

- the replacement of circular hysteresis H by bi-directional circular deviation $G(b)$, because of the difficulty of evaluating circular hysteresis H by commonly available metrology instruments, and because bi-directional circular deviation $G(b)$ contains similar information,
- the introduction of the mean bi-directional radial deviation, D ,
- addition of the word “counter-clockwise”, the US variant of “anticlockwise”, for purposes of clarity where US usage is the norm,
- mention of measurement and test uncertainty,
- the inclusion of parameters $G(b)$ and D in Annex A, and
- modification of the wording of 3.8 and B.3.1.

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 machine tools*
- *Part 3: Determination of thermal effects*
- *Part 4: Circular tests for numerically controlled machine tools*
- *Part 5: Determination of the 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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Part 4:

Circular tests for numerically controlled machine tools

1 Scope

This part of ISO 230 specifies methods of testing and evaluating the bi-directional circular deviation, the mean bi-directional radial deviation, the circular deviation and the radial deviation of circular paths that are produced by the simultaneous movements of two linear axes. Relevant measuring instruments are described in ISO 230-1:1996, 6.63.

The objective of this part of ISO 230 is to provide a method for the measurement of the contouring performance of a numerically controlled machine tool.

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*.

3 Terms and definitions

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

3.1

nominal path

numerically controlled and programmed circular path defined by its diameter (or radius), the position of its centre and its orientation in the working zone of the machine tool and which may be either a full circle or a partial circle of at least 90°

3.2

actual path

path produced by the machine tool when programmed to move on the nominal path

3.3

bi-directional circular deviation

$G(b)$

minimum radial separation of two concentric circles (minimum zone circles) enveloping two actual paths, where one path is carried out by a clockwise contouring motion and the other one by an anticlockwise (counter-clockwise) contouring motion

See Figure 1.