
**Test conditions for numerically controlled
turning machines and turning centres —**

**Part 6:
Accuracy of a finished test piece**

*Conditions d'essai des tours à commande numérique et des centres de
tournage —*

Partie 6: Exactitude d'une pièce d'essai usinée



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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

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 13041-6 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 13041-6:2005), which has been technically revised.

ISO 13041 consists of the following parts, under the general title *Test conditions for numerically controlled turning machines and turning centres*:

- *Part 1: Geometric tests for machines with a horizontal workholding spindle*
- *Part 2: Geometric tests for machines with a vertical workholding spindle*
- *Part 3: Geometric tests for machines with inverted vertical workholding spindles*
- *Part 4: Accuracy and repeatability of positioning of linear and rotary axes*
- *Part 5: Accuracy of feeds, speeds and interpolations*
- *Part 6: Accuracy of a finished test piece*
- *Part 7: Evaluation of contouring performance in the coordinate planes*
- *Part 8: Evaluation of thermal distortions*

Introduction

A numerically controlled turning machine is a machine tool in which the principal motion is the rotation of the workpiece against the stationary cutting tool(s) and where cutting energy is brought by the workpiece and not by the tool. This machine is controlled by a numerical control (NC) providing automatic functioning in accordance with ISO 13041-1:2004, 3.3, and can be of single spindle or multi-spindle type.

A turning centre is an NC turning machine equipped with power-driven tool(s) and the capacity to orientate the workholding spindle around its axis. This machine can include additional features, such as automatic tool changing from a magazine.

The objective of the ISO 13041 series is to supply as wide and comprehensive information as possible on geometric, positional, contouring, thermal and machining tests, which can be carried out for comparison, acceptance, maintenance or any other purpose.

The ISO 13041 series specifies, with reference to the relevant parts of ISO 230, tests for turning centres and numerically controlled turning machines with/without tailstocks, standing alone or integrated in flexible manufacturing systems. It also establishes the tolerances or maximum acceptable values for the test results corresponding to general purpose and normal accuracy turning centres and numerically controlled turning machines.

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Test conditions for numerically controlled turning machines and turning centres —

Part 6: Accuracy of a finished test piece

1 Scope

This part of ISO 13041 specifies, with reference to ISO 230-1, a series of cutting tests, under finishing conditions, of standard test pieces. It also specifies the characteristics and dimensions of the test pieces themselves.

This part of ISO 13041 is intended to supply minimum requirements for assessing the cutting accuracy of the machine.

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 1101, *Geometrical Product Specifications (GPS) — Geometrical tolerancing — Tolerances of form, orientation, location and run-out*

ISO 13041-1:2004, *Test conditions for numerically controlled turning machines and turning centres — Part 1: Geometric tests for machines with a horizontal workholding spindle*

ISO 13041-2, *Test conditions for numerically controlled turning machines and turning centres — Part 2: Geometric tests for machines with a vertical workholding spindle*

ISO 13041-3, *Test conditions for numerically controlled turning machines and turning centres — Part 3: Geometric tests for machines with inverted vertical workholding spindles*

3 Preliminary remarks

3.1 Measuring units

In this part of ISO 13041, 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 expressed in ratios, but in some cases microradians or arcseconds may be used for clarification purposes. The equivalence of the following expressions should always be kept in mind.

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