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**Machine tools — Short-term capability  
evaluation of machining processes on  
metal-cutting machine tools**

*Machines-outils — Évaluation de la capacité des procédés d'usinage  
des machines-outils travaillant par enlèvement de métal*



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Published in Switzerland

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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.

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](http://www.iso.org/directives)).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document 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 26303:2012), which has been technically revised. The main changes compared with the previous edition are as follows:

- additional explanations have been added in 6.6 "Measurement" and for Formula (23);
- the indices of variables in Formulae (3) and (18) have been corrected;
- agreement forms 2 to 4 of Annex B, analysis form 2 of Annex C, agreement forms 3 and 4 of Annex D and analysis forms 1 and 2 of Annex D have been corrected;
- the references in Figure 2 have been revised;
- Figure A.1 has been improved;
- the status of Annexes B and C has been changed to informative;
- the formulae in analysis form 4 of Annex C and in analysis form 4 of Annex D have been corrected;
- the Bibliography has been updated.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

The evaluation of the short-term capability of the machining process is a different approach in machine tool assessment compared with machine tool performance testing methods, which are covered by a number of International Standards, e.g. ISO 230 (all parts) and other machine tool type specific standards. The main differences are machining a sample batch of test pieces and definition of the relevant influencing factors as well as the statistical conditioning and analysis of the workpiece quality related data obtained during such tests.

This document is the result of a project guided closely by an international working group, and summarized in order to make the information available to as many interested parties as possible.

Especially for large batch production, short-term process capability estimates, as well as capacity measures, are very often applied in addition to testing of machine tool performances. In fact, machine tool users increasingly employ statistical process control (SPC) techniques in their activities and frequently ask the machine suppliers/manufacturers to become system suppliers as well, giving them responsibilities for the machining process too.

Statistical methods in process management are covered by ISO 22514 (all parts).

For the purposes of machine tool acceptance based on the test of its capability in machining a specified workpiece, both requirements and methods stated by individual users differ widely, due to the absence of a recognized International Standard. Long-winded discussions and adaptation processes during the acceptance tests are, therefore, often necessary, delaying delivery to the customer and causing great time- and cost-related expenditure. This document provides a unified procedure for the acceptance test of a machine tool based on its short-term process capability. It introduces:

- the short-term capability of a given process, which employs the machine tool under test, the machining process, tooling and clamping applied, as well as the workpiece properties;
- the estimate of relevant machine capability indexes.

This document adapts to and conforms to the specifications established in ISO 22514 (all parts). However, the term “process performance index” specified in ISO 3534-2:2006 and used in ISO 22514-3:2020 corresponds for normal distribution to the term “short-term capability” in this document. The term “short-term capability” has been widely used in the machine tool industry for many years; therefore, ISO/TC 39/SC 2 decided to maintain this term.

Combined with the statistical evaluation, many influencing factors significantly restrict the fraction of tolerance interval covered by machine tool variations. As a consequence, the machine capability indices are specified in conjunction with the test conditions and the required tolerance limits.



# Machine tools — Short-term capability evaluation of machining processes on metal-cutting machine tools

## 1 Scope

This document specifies procedures for acceptance of metal-cutting machine tools based on the tests of their capability in machining a specified workpiece (i.e. indirect testing). It gives recommendations for test conditions, applicable measurement systems and the requirements for machine tools.

This document is consistent with ISO 22514 (all parts) describing statistical methods for process management and deals with the specific application of those methods to machine tools and machining of a sample batch of test pieces. This document covers neither functional tests, which are generally carried out before testing the accuracy performance, nor the testing of the safety conditions of the machine tool.

Annex A gives additional information related to statistical evaluation, Annexes B and C provide agreement and evaluations forms for short-term capability tests, while Annex D gives an example.

NOTE 1 Direct testing aims to investigate individual machine tool properties, such as geometric or positioning accuracy. Short-term capability evaluation is meant to prove that a machine tool has the capability to fulfil a specific process task. It is, therefore, important to recognize that the short-term capability test is focused only on the manufactured product. This means that direct testing methods are more suited for the determination of error sources on the machine tool and for deriving constructive improvements of a machine tool that is used in a wide production spectrum; a short-term capability test is less suited for detection of error sources of the machine tool. Therefore, it is expected that short-term capability evaluation for the acceptance of metal-cutting machine tools in machining processes be primarily carried out on workpiece-dependent special-purpose machines, e.g. working stations of transfer lines, with a process-determined cycle time of less than 10 min, so that at least 50 workpieces are manufactured in one shift as the statistical uncertainty increases strongly for a smaller number. In principle, short-term capability evaluation can also be performed on universal machine tools, such as machining centres used for large batch production if they meet the above-mentioned statistical requirements.

NOTE 2 The term “short-term capability”, which is a widely used term in machine tool industry, corresponds to the term “process performance index” specified in ISO 3534-2:2006 for normal distribution.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 4288, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Rules and procedures for the assessment of surface texture*

## 3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>