INTERNATIONAL STANDARD

ISO 230-12

First edition
2022-06

Test code for machine tools —

Part 12: Accuracy of finished test pieces

Code d'essai des machines-outils —

Partie 12: Exactitude des pièces d'essai finies

Reference number
ISO 230-12:2022(E)

COPYRIGHT PROTECTED DOCUMENT

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

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).

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).

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.

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

A list of all parts in the ISO 230 series can be found on the ISO website.

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.

Introduction

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

When a machine tool is used to repeatedly machine a single test piece in a mass production line, some machine tool users want to test cut that single test piece and check its geometric accuracy, as a part of acceptance tests for a machine tool. For machines machining multiple types of test pieces, standard test pieces should be used. The geometric error of the finished test piece can be caused by various error motions of a spindle, linear axes, rotary axes, or other mechanical components of a machine tool. A proper set of machining tests should be chosen such that it exhibits the influence of machine error motions for a machine tool user's possible machining applications. This document specifies a set of machining tests that can be used to assess the influence of various quasi-static error motions of a machine tool. This document is intended to supply minimum requirements for assessing the finish-cutting accuracy of the machine.

Standard test pieces are defined in machine-specific International Standards. In some machine-specific International Standards, recent machining applications are not be fully covered. For example, five-axis machining centres can perform turning operations by using a rotary table. The machine-specific International Standard for a machining centre, ISO 10791-7, describes no machining test for turning operation. Turning tests are included in ISO 13041-5. This document describes a family of machining tests that covers potential applications of various types of machine tools.

In general, machining tests described in machine-specific international standards, influenced by multiple causes, are not intended to identify individual error sources contributing to the measured errors of the machined test pieces. In contrast, tests for identifying quasi-static error motions described in ISO 230-1 are designed to identify individual error sources for each motion axis. This document provides test pieces for machining tests to isolate certain error sources and allow manufacturers/users to pick those corresponding to their intended machining applications.

The tests described in this document can be used either for testing different types of machine tools (type testing) or testing individual machine tools for acceptance purposes.

Test code for machine tools —

Part 12:
Accuracy of finished test pieces

1 Scope

This document specifies methods for defining machining tests for manufacturing accurate test pieces, and for evaluating the influence of quasi-static geometric errors of linear axes and rotary axes, and the influence of the synchronization error of simultaneously controlled multiple axes. Although quasi-static geometric errors are often major contributors for geometric errors of finished test pieces, other factors, e.g. the dynamic contouring error, can also have significant influence.

This document describes examples of test piece geometry applicable to individual machine tools, possible contributors to machining error, deviations to be measured and measuring instruments. By clarifying possible contributors to machining error in each machining test, this document gives a guidance to machine tool manufacturers or users such that proper machining tests can be chosen to evaluate a machine tool's machining performance in specified machining applications.

Machining tests to evaluate the geometric accuracy of a single surface are described in Clause 5, and those to evaluate geometric relationship of multiple machining features are described in Clause 6. Clause 7 presents machining tests for other objectives: machining tests for evaluation of short-term capability (7.2), and machining tests for evaluation of thermal influence (7.3).

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

ISO 1101:2017, *Geometrical product specifications (GPS) — Geometrical tolerancing — Tolerances of form, orientation, location and run-out*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 230-1:2012 and ISO 1101:2017 apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/