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English Version

Geometrical product specifications (GPS) - Coordinate measuring machines (CMM): Technique for determining the uncertainty of measurement - Part 3: Use of calibrated workpieces or standards (ISO/TS 15530-3:2004)

Spécification géométrique des produits (GPS) - Machines à mesurer tridimensionnelles (MMT): Technique pour la détermination de l'incertitude de mesure - Partie 3: Utilisation de pièces étalonnées ou des normes (ISO/TS 15530-3:2004)

Geometrische Produktspezifikation (GPS) - Verfahren zur Ermittlung der Messunsicherheit von Koordinatenmessgeräten (KMG) - Teil 3: Anwendung von kalibrierten Werkstücken oder Normalen (ISO/TS 15530-3:2004)

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Foreword

The text of ISO/TS 15530-3:2004 has been prepared by Technical Committee ISO/TC 213 “Dimensional and geometrical product specifications and verification” of the International Organization for Standardization (ISO) and has been taken over as CEN ISO/TS 15530-3:2007 by Technical Committee CEN/TC 290 “Dimensional and geometrical product specification and verification” the secretariat of which is held by AFNOR.

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Endorsement notice

The text of ISO/TS 15530-3:2004 has been approved by CEN as a CEN ISO/TS 15530-3:2007 without any modification.

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Introduction

This part of ISO 15530 is a Geometrical Product Specification (GPS) Technical Specification and is to be regarded as a general GPS document (see ISO/TR 14638). It influences chain link 6 of the chain of standards on size, distance, radius, angle, form, orientation, location, run-out and datums.

For more detailed information on the relation of this standard to the GPS matrix model, see Annex B.

Coordinate measuring machines (CMMs) have become essential for the verification of geometry in industry. According to the ISO 9000 series of standards, in a quality management system the relevant measuring equipment is required to be calibrated against certified equipment having a known and valid relationship to internationally or nationally recognized standards in order to establish traceability. According to the *International Vocabulary of Basic and General Terms in Metrology* (VIM), a calibration comprises — besides the establishment of the relationship between the measured and the correct values of a quantity — the uncertainty evaluation in the final results (measurands) of the measurement task. However, uncertainty evaluation methods covering the errors arising in the innumerable measurement tasks a CMM can actually perform are often very complex. In these cases the risk of an unrealistic estimation of task-related uncertainty is likely to arise.

The aim of this part of ISO 15530 is to provide an experimental technique for simplifying the uncertainty evaluation of CMM-measurements. In this experimental approach measurements are carried out in the same way as actual measurements, but with calibrated workpieces or standards of similar dimension and geometry instead of the unknown objects to be measured. The description of this experimental technique to evaluate measurement uncertainty is the key element of this part of ISO 15530. The standardization of such procedures for the uncertainty evaluation serves the world-wide mutual recognition of calibrations and other measurement results.

This part of ISO 15530 is applicable for non-substitution measurement of workpieces or standards, where the measurement result is given by the indication of the CMM. Furthermore, this part of ISO 15530 is applicable for substitution measurement, where, in opposition to the non-substitution measurement, a check standard is used to correct for the systematic errors of the CMM. The latter will generally decrease the measurement uncertainty and is often used, especially in the field of gauge calibration.

This part of ISO 15530 describes one of several methods of uncertainty evaluation, which will be outlined in later ISO documents. Because of the experimental approach, it is simple to perform, and it provides realistic statements of measurement uncertainties.

The limitations of this method can be summarised as: the availability of artefacts with sufficiently defined geometrical characteristics, stability, reasonable costs, and the possibility of being calibrated with sufficiently small uncertainty.

Geometrical Product Specifications (GPS) — Coordinate measuring machines (CMM): Technique for determining the uncertainty of measurement —

Part 3: Use of calibrated workpieces or standards

1 Scope

This part of ISO 15530 specifies the evaluation of measurement uncertainty for results of measurements obtained by a CMM and by using calibrated workpieces. It provides an experimental technique for simplifying the uncertainty evaluation of CMM measurements, whose approach (substitution measurements) leads to measurements being carried out in the same way as actual measurements, but with calibrated workpieces of similar dimension and geometry instead of the unknown workpieces to be measured.

Non-substitution measurements on CMMs are also covered, as are the requirements of the uncertainty evaluation procedure, the measurement equipment needed, and the reverification and the interim check of the measurement uncertainty.

NOTE The evaluation of measurement uncertainty is always related to a specific measuring task.

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 10360-1:2000, *Geometrical Product Specifications (GPS) — Acceptance and reverification tests for coordinate measuring machines (CMM) — Part 1: Vocabulary*

International vocabulary of basic and general terms in metrology (VIM). BIPM, IEC, IFCC, ISO, IUPAC, IUPAP, OIML, 2nd edition, 1993

Guide to the expression of uncertainty in measurement (GUM). BIPM, IEC, IFCC, ISO, IUPAC, IUPAP, OIML, 1st edition, 1993, corrected and reprinted in 1995

3 Terms and definitions

For the purpose of this part of ISO 15530, the terms and definitions given in ISO 10360-1, VIM and GUM, and the following apply

3.1

non-substitution measurement

measurement where the uncorrected indication of the CMM is used as a result