NSAI Standards

Standard Recommendation
S.R. CEN ISO/TS 15530-1:2013

Geometrical product specifications (GPS) - Coordinate measuring machines (CMM): Technique for determining the uncertainty of measurement - Part 1: Overview and metrological characteristics (ISO/TS 15530-1:2013)

S.R. CEN ISO/TS 15530-1:2013

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TECHNICAL SPECIFICATION

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English Version

Geometrical product specifications (GPS) - Coordinate measuring machines (CMM): Technique for determining the uncertainty of measurement - Part 1: Overview and metrological characteristics (ISO/TS 15530-1:2013)

Spécification géométrique des produits (GPS) - Machines à mesurer tridimentionnelles (MMT): Technique pour la détermination de l'incertitude de mesure - Partie 1: Vue d'ensemble et caractéristiques métrologiques (ISO/TS 15530-1:2013)

Geometrische Produktspezifikation und -prüfung (GPS) - Verfahren zur Ermittlung der Messunsicherheit von Koordinatenmessgeräten (KMG) - Teil 1: Übersicht und metrologische Merkmale (ISO/TS 15530-1:2013)

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Foreword

This document (CEN ISO/TS 15530-1:2013) has been prepared by Technical Committee ISO/TC 213 "Dimensional and geometrical product specifications and verification" in collaboration with Technical Committee CEN/TC 290 “Dimensional and geometrical product specification and verification” the secretariat of which is held by AFNOR.

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The text of ISO/TS 15530-1:2013 has been approved by CEN as CEN ISO/TS 15530-1:2013 without any modification.

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TECHNICAL SPECIFICATION

ISO/TS 15530-1

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

Part 1: Overview and metrological characteristics

Spécification géométrique des produits (GPS) — Machines à mesurer tridimentionnelles (MMT): Technique pour la détermination de l'incertitude de mesure —

Partie 1: Vue d'ensemble et caractéristiques métrologiques

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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. www.iso.org/directives

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The committee responsible for this document is ISO/TC 213, *Dimensional and geometrical product specifications and verification*.

ISO 15530 consists of the following parts, under the general title *Geometrical product specifications (GPS) — Coordinate measuring machines (CMM): Technique for determining the uncertainty of measurement*:

— *Part 1: Overview and metrological characteristics* [Technical Specification]

— *Part 3: Use of calibrated workpieces or measurement standards*

— *Part 4: Evaluating task-specific measurement uncertainty using simulation* [Technical Specification]

Introduction

This part of ISO 15530 is a general GPS document which influences chain link 6 of the chain of standards on size, distance, radius, angle, form, orientation, location, run-out and datums in the general GPS matrix.

The ISO/GPS masterplan given in ISO/TR 14638 gives an overview of the ISO/GPS system of which this document is a part. The fundamental rules of ISO/GPS given in ISO 8015 apply to this document and the default decision rules given in ISO 14253-1 apply to specifications made in accordance with this document, unless otherwise indicated.

For more detailed information on the relation of this part of ISO 15530 to other standards and the GPS matrix model, see Annex C.

It is the purpose of the ISO 15530 series to provide terminology, techniques and guidelines for estimating task-specific measurement uncertainty when using coordinate measuring machines (CMMs). These techniques allow for the evaluation of sources of uncertainty that affect a stated measurement, including the influence of the coordinate measuring system, the sampling strategy, environmental effects, operator variability and any other factors affecting the actual measurement result.

CMMs are considered to be complex GPS measuring equipment, and the estimation of the uncertainty of CMM measurements often involves more advanced techniques than those described in ISO 14253-2. The techniques presented in the ISO 15530 series are compliant with both ISO 14253-2 and ISO/IEC Guide 98-3 (GUM). The techniques are developed specifically for CMMs but could be applied to other GPS measuring equipment.

CMMs are specified by acceptance tests in the ISO 10360 series, which typically involve their ability to measure calibrated lengths (e.g. volumetric tests using calibrated gauge blocks or step gauges) and form (e.g. probing tests using a calibrated sphere). It is recognized that although these test results may be used to determine an uncertainty for the specific types of length and form measurements involved in these procedures, without further analysis or testing, these results are insufficient to determine the task-specific measurement uncertainty of most workpiece measurements.

The goal of determining the measurement uncertainty can be achieved through many different techniques; however, all methods must be consistent with ISO/IEC Guide 98-3, which yields a combined standard uncertainty. The expanded uncertainty is connected to the combined standard uncertainty via the coverage factor, which is selected to produce the desired level of confidence. The default value for the coverage factor is two, i.e. $k = 2$, which yields a level of confidence of approximately 95 % if the uncertainty is associated with a Gaussian distribution. It is the purpose of this document to provide guidance on recognized techniques for the estimation of uncertainty of CMM measurements.

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

Part 1: Overview and metrological characteristics

1 Scope

This part of ISO 15530 provides an overview of the ISO 15530 series. It discusses the metrological characteristics of coordinate measuring machines (CMMs), the sources of task-specific uncertainty, and the relationship between the ISO 10360 and ISO 15530 series.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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*

ISO 14253-1:—[1)], *Geometrical product specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 1: Decision rules for proving conformity or nonconformity with specifications*

ISO 14253-2:2011, *Geometrical product specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 2: Guidance for the estimation of uncertainty in GPS measurement, in calibration of measuring equipment and in product verification*

ISO 14978:2006, *Geometrical product specifications (GPS) — General concepts and requirements for GPS measuring equipment*

ISO/IEC Guide 98-3, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

ISO/IEC Guide 99, *International vocabulary of metrology — Basic and general concepts and associated terms (VIM)*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in ISO 10360-1, ISO 14253-1, ISO 14253-2, ISO 14978, ISO/IEC Guide 98-3, ISO/IEC Guide 99 and the following apply.

3.1
task-specific measurement uncertainty
expanded uncertainty using a coverage factor of two (k = 2), evaluated according to ISO/IEC Guide 98-3, of a specific measurement result

Note 1 to entry: Task-specific measurement uncertainty takes into account all uncertainty sources associated with the details of the measurement process, including the CMM, probing system, sampling strategy, workpiece location and orientation, fixturing, contamination, thermal environment.

1) To be published. (Revision of ISO 14253-1:1998)