



NSAI
Standards

Irish Standard
I.S. EN 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

I.S. EN ISO 14253-2:2011

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**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 14253-2:2011)**

Spécification géométrique des produits (GPS) - Vérification
par la mesure des pièces et des équipements de mesure -
Partie 2: Lignes directrices pour l'estimation de l'incertitude
dans les mesures GPS, dans l'étalonnage des
équipements de mesure et dans la vérification des produits
(ISO 14253-2:2011)

Geometrische Produktspezifikationen (GPS) - Prüfung von
Werkstücken und Messgeräten durch Messen - Teil 2:
Leitfaden zur Schätzung der Unsicherheit von GPS-
Messungen bei der Kalibrierung von Messgeräten und bei
der Produktprüfung (ISO 14253-2:2011)

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Foreword

This document (EN ISO 14253-2:2011) 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.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2011, and conflicting national standards shall be withdrawn at the latest by October 2011.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes ENV ISO 14253-2:2001.

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**INTERNATIONAL
STANDARD**

**ISO
14253-2**

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**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**

*Spécification géométrique des produits (GPS) — Vérification
par la mesure des pièces et des équipements de mesure —*

*Partie 2: Lignes directrices pour l'estimation de l'incertitude dans les
mesures GPS, dans l'étalonnage des équipements de mesure et dans
la vérification des produits*



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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 14253-2 was prepared by Technical Committee ISO/TC 213, *Dimensional and geometrical product specifications and verification*.

This first edition of ISO 14253-2 cancels and replaces ISO/TS 14253-2:1999, which has been technically revised. It also incorporates the Technical Corrigendum ISO/TS 14253-2:1999/Cor.1:2007.

ISO 14253 consists of the following parts, under the general title *Geometrical product specifications (GPS) — Inspection by measurement of workpieces and measuring equipment*:

- *Part 1: Decision rules for proving conformance or non-conformance with specifications*
- *Part 2: Guidance for the estimation of uncertainty in GPS measurement, in calibration of measuring equipment and in product verification*
- *Part 3: Guidelines for achieving agreements on measurement uncertainty statements*
- *Part 4: Background on functional limits and specification limits in decision rules* [Technical Specification]

Introduction

This part of ISO 14253 is a global GPS standard (see ISO/TR 14638:1995). This global GPS standard influences chain links 4, 5 and 6 in all chains of standards.

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 International Standard to other standards and to the GPS matrix model, see Annex D.

This part of ISO 14253 has been developed to support ISO 14253-1. This part of ISO 14253 establishes a simplified, iterative procedure of the concept and the way to evaluate and determine uncertainty (standard uncertainty and expanded uncertainty) of measurement, and the recommendations of the format to document and report the uncertainty of measurement information as given in the *Guide to the expression of uncertainty in measurement* (GUM). In most cases, only very limited resources are necessary to estimate uncertainty of measurement by this simplified, iterative procedure, but the procedure may lead to a slight overestimation of the uncertainty of measurement. If a more accurate estimation of the uncertainty of measurement is needed, the more elaborated procedures of the GUM need to be applied.

This simplified, iterative procedure of the GUM methods is intended for GPS measurements, but may be used in other areas of industrial (applied) metrology.

The uncertainty of measurement and the concept of handling uncertainty of measurement are important to all the technical functions within a company. This part of ISO 14253 is relevant to several technical functions, including management, design and development, manufacturing, quality assurance and metrology.

This part of ISO 14253 is of special importance in relation to ISO 9000 quality assurance systems, e.g. it is a requirement that methods for monitoring and measurement of the quality management system processes are suitable. The measurement uncertainty is a measure of the process suitability.

In this part of ISO 14253, the uncertainty of the result of a process of calibration and a process of measurement is handled in the same way:

- calibration is treated as a “measurement of the metrological characteristics of a measuring equipment or a measurement standard”;
- measurement is treated as a “measurement of the geometrical characteristics of a workpiece”.

Therefore, in most cases, no distinction is made in the text between measurement and calibration. The term “measurement” is used as a synonym for both.

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

1 Scope

This part of ISO 14253 gives guidance on the implementation of the concept of the “Guide to the estimation of uncertainty in measurement” (in short GUM) to be applied in industry for the calibration of (measurement) standards and measuring equipment in the field of GPS and the measurement of workpiece GPS characteristics. The aim is to promote full information on how to achieve uncertainty statements and provide the basis for international comparison of measurement results and their uncertainties (relationship between purchaser and supplier).

This part of ISO 14253 is intended to support ISO 14253-1. Both parts are beneficial to all technical functions in a company in the interpretation of GPS specifications [i.e. tolerances of workpiece characteristics and values of maximum permissible errors (MPEs) for metrological characteristics of measuring equipment].

This part of ISO 14253 introduces the Procedure for Uncertainty Management (PUMA), which is a practical, iterative procedure based on the GUM for estimating uncertainty of measurement without changing the basic concepts of the GUM. It is intended to be used generally for estimating uncertainty of measurement and giving statements of uncertainty for:

- single measurement results;
- the comparison of two or more measurement results;
- the comparison of measurement results — from one or more workpieces or pieces of measurement equipment — with given specifications [i.e. maximum permissible errors (MPEs) for a metrological characteristic of a measurement instrument or measurement standard, and tolerance limits for a workpiece characteristic, etc.], for proving conformance or non-conformance with the specification.

The iterative method is based basically on an upper bound strategy, i.e. overestimation of the uncertainty at all levels, but the iterations control the amount of overestimation. Intentional overestimation — and not underestimation — is necessary to prevent wrong decisions based on measurement results. The amount of overestimation is controlled by economical evaluation of the situation.

The iterative method is a tool to maximize profit and minimize cost in the metrological activities of a company. The iterative method/procedure is economically self-adjusting and is also a tool to change/reduce existing uncertainty in measurement with the aim of reducing cost in metrology (manufacture). The iterative method makes it possible to compromise between risk, effort and cost in uncertainty estimation and budgeting.

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