
**Geometrical product specifications
(GPS) — Inspection by measurement
of workpieces and measuring
equipment —**

Part 1:

**Decision rules for proving conformity
or nonconformity with specifications**
(standards.iteh.ai)

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

*Partie 1: Règles de décision pour prouver la conformité ou la non-
conformité à la spécification*



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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

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. 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 on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

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

This second edition cancels and replaces the first edition (ISO 14253-1:1998), which has been technically revised.

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 conformity or nonconformity 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 [TS]*
- *Part 5: Uncertainty in testing indicating measuring instruments*
- *Part 6: Generalized decision rules for the acceptance and rejection of instruments and workpieces [TR]*

Introduction

This part of ISO 14253 is a geometrical product specifications (GPS) standard and is to be regarded as a global GPS standard (see ISO/TR 14638). It influences the chain links 4, 5 and 6 of all chains of general GPS 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 this document apply in ISO/GPS, unless otherwise indicated.

For more detailed information on the relation of this part of ISO 14253 to other standards and the GPS matrix model, see [Annex A](#).

The estimated measurement uncertainty is to be taken into account when providing evidence for conformity or nonconformity with specification.

The problem arises when a measurement result falls close to the upper or lower specification limit. In this case it is not possible to prove conformity or nonconformity with specifications, since the measurement result plus or minus the expanded measurement uncertainty includes one of the specification limits.

Therefore, a supplier/customer agreement should be foreseen in order to solve the problems which could arise. This part of ISO 14253 explains how to handle specification and measurement uncertainty and establishes decision rules for proving conformity or nonconformity with specification.

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Geometrical product specifications (GPS) — Inspection by measurement of workpieces and measuring equipment —

Part 1:

Decision rules for proving conformity or nonconformity with specifications

1 Scope

This part of ISO 14253 establishes the rules for determining the conformity or nonconformity with a given tolerance for a characteristic of a workpiece (or a population of workpieces) or limits of maximum permissible errors for a metrological characteristic of a measuring equipment, taking into account the measurement uncertainty.

These rules are different for tolerances to individual workpieces and tolerances to workpiece populations.

It also gives rules on how to deal with cases where a clear decision (conformity or nonconformity with specification) cannot be taken, i.e. when the measurement result falls within the uncertainty range (see 3.23) that exists around the specification limits.

This part of ISO 14253 applies to specifications defined in general GPS standards (see ISO/TR 14638), i.e. standards prepared by ISO/TC 213, including:

- workpiece/population of workpieces specifications (usually given as an upper tolerance limit or a lower tolerance limit or both), and;
- measuring equipment specifications (usually given as maximum permissible errors).

This part of ISO 14253 only applies for characteristics expressed as numerical quantity values.

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 3534-2:2006, *Statistics — Vocabulary and symbols — Part 2: Applied statistics*

ISO 9000:2005, *Quality management systems — Fundamentals and vocabulary*

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 purposes of this document, the terms and definitions given in ISO 3534-2, ISO 9000, ISO/IEC Guide 98-3 and ISO/IEC Guide 99 and the following apply.

3.1
tolerance

T

difference between the upper and lower *tolerance limits* (3.3)

Note 1 to entry: The tolerance is a quantity without sign.

Note 2 to entry: A tolerance may be two-sided or one-sided. The tolerance zone does not necessarily include the nominal value.

[SOURCE: ISO 3534-2:1993, 1.4.4, modified — The two notes to entry have been added.]

3.2
tolerance zone
tolerance interval

variate values of the characteristic between and including the *tolerance limits* (3.3)

[SOURCE: ISO 3534-2:1993, 1.4.5]

3.3
tolerance limits
limiting values

specified values of the characteristic giving upper and/or lower bounds of the permissible value

[SOURCE: ISO 3534-2:1993, 1.4.3]

3.4
maximum permissible measurement error
MPE

maximum permissible error

limit of error

extreme value of measurement error with respect to a known reference quantity value, permitted by specifications or regulations for a given measurement, measuring instrument, or measuring system

Note 1 to entry: Usually, the term “maximum permissible errors” or “limits of error” is used where there are two extreme values.

Note 2 to entry: The term “tolerance” should not be used to designate “maximum permissible error”.

[SOURCE: ISO/IEC Guide 99:2007, definition 4.26, modified — The abbreviated term, MPE, has been added.]

3.5
specification

tolerance (3.1) on a workpiece characteristic or population characteristic or the *maximum permissible error* (3.4) of a measuring equipment characteristic

Note 1 to entry: A specification should refer to or include drawings, patterns or other relevant documents and indicate the means and the criteria whereby conformity can be checked.

3.6
specification zone
specification interval

variate values of the workpiece characteristic or population characteristic or the measuring equipment characteristic between and including the *specification limits* (3.7)

3.7
specification limit

tolerance limit (3.3) of a workpiece characteristic or population characteristic or *maximum permissible error* (3.4) of a measuring equipment characteristic

3.8**upper specification limit****USL**

specified value giving either:

- the upper boundary of the permissible values of the *tolerance limits* (3.3) of a workpiece characteristic or population characteristic; or
- the upper boundary of the permissible values of the permissible errors of a measuring equipment characteristic

3.9**lower specification limit****LSL**

specified value giving either:

- the lower boundary of the permissible values of the *tolerance limits* (3.3) of a workpiece characteristic or population characteristic; or
- the lower boundary of the permissible values of the permissible errors of a measuring equipment characteristic

3.10**measurand****Y**

quantity intended to be measured

[SOURCE: ISO/IEC Guide 99:2007, definition 2.3, modified — The notes are not reproduced. The symbol has been added.]

3.11**measurement result**

result of measurement

y

set of quantity values being attributed to a *measurand* (3.10) together with any other available relevant information

[SOURCE: ISO/IEC Guide 99:2007, definition 2.9, modified — The notes are not reproduced. The symbol has been added.]

3.12**nominal value**

designated value of a characteristic in a given design specification or drawing

3.13**measurement uncertainty**

uncertainty of measurement

uncertainty

non-negative parameter characterizing the dispersion of the quantity values being attributed to a *measurand* (3.10), based on the information used

[SOURCE: ISO/IEC Guide 99:2007, definition 2.26, modified — The notes are not reproduced.]

3.14**standard measurement uncertainty**

standard uncertainty of measurement

standard uncertainty

measurement uncertainty (3.13) expressed as a standard deviation

[SOURCE: ISO/IEC Guide 99:2007, definition 2.30, modified — The notes are not reproduced.]

3.15

combined standard measurement uncertainty

combined standard uncertainty

standard measurement uncertainty (3.14) that is obtained using the individual standard measurement uncertainties associated with the input quantities in a measurement model

[SOURCE: ISO/IEC Guide 99:2007, definition 2.31, modified — The note is not reproduced.]

3.16

expanded measurement uncertainty

expanded uncertainty

U

product of a *combined standard measurement uncertainty* (3.15) and a factor larger than the number one

[SOURCE: ISO/IEC Guide 99:2007, definition 2.35, modified — The notes are not reproduced. The symbol has been added.]

3.17

coverage factor

k

number larger than one by which a *combined standard measurement uncertainty* (3.15) is multiplied to obtain an *expanded measurement uncertainty* (3.16)

[SOURCE: ISO/IEC Guide 99:2007, definition 2.38, modified — The notes are not reproduced. The symbol is added.]

3.18

complete measurement result

y'

measurement result (3.11) including the *expanded measurement uncertainty* (3.16)

Note 1 to entry: The complete measurement result is expressed by the equation given in [Clause 4](#).

3.19

conformity

fulfilment of a requirement

Note 1 to entry: The term “conformance” is synonymous but deprecated.

[SOURCE: ISO 9000:2005, definition 3.6.1]

3.20

conformity zone

specification zone (3.6) reduced by the *expanded measurement uncertainty* (3.16)

Note 1 to entry: The specification is reduced by the expanded measurement uncertainty at the *upper specification limit* (3.8) and/or the *lower specification limit* (3.9).

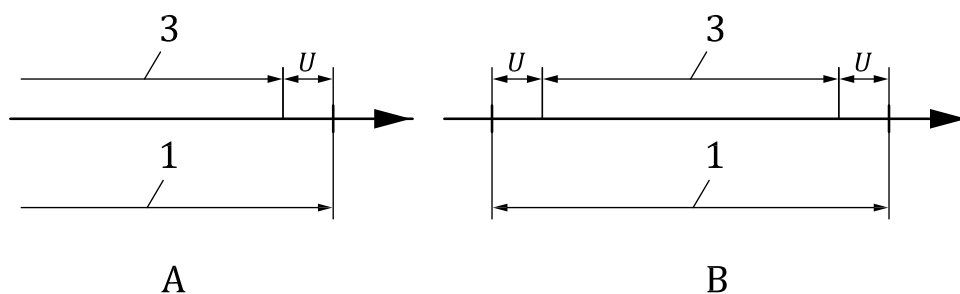
Note 2 to entry: See [Figure 1](#).

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**Key**

- A one-sided specification
- B two-sided specification
- 1 specification zone
- 3 conformity zone

Figure 1 — Conformity zone**3.21****nonconformity**

non-fulfilment of a requirement

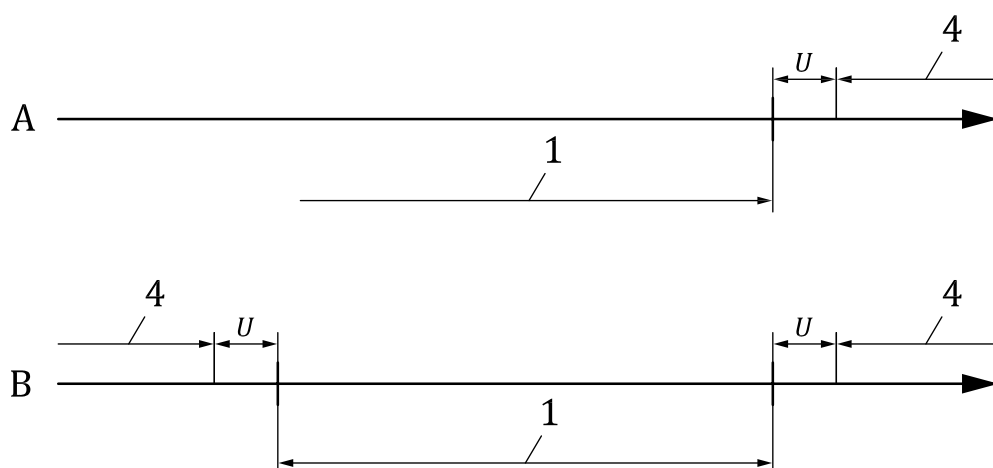
[SOURCE: ISO 9000:2005, definition 3.6.2]

3.22**nonconformity zone**

zone(s) outside the *specification zone* (3.6) extended by the *expanded measurement uncertainty* (3.16)

Note 1 to entry: The specification is extended by the expanded measurement uncertainty, U , at the *upper specification limit* (3.8) and/or the *lower specification limit* (3.9).

Note 2 to entry: See [Figure 2](#).

**Key**

- A one-sided specification
- B two-sided specification
- 1 specification zone
- 4 nonconformity zone

Figure 2 — Nonconformity zone