PUBLICLY AVAILABLE SPECIFICATION

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Geometrical product specification (GPS) — Coordinate measuring machines (CMM): Testing the performance of CMMs using single-stylus contacting probing systems

Spécification géométrique des produits (GPS) — Machines à mesurer tridimensionnelles (MMT): Essai de performance des MMT utilisant des systèmes de palpage à stylet simple

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Foreword

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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.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of document:

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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/PAS 12868 was prepared by Technical Committee ISO/TC 213, *Dimensional and geometrical product specifications and verification*.

Introduction

This Publicly Available Specification specifies the acceptance and reverification tests for coordinate measuring machine (CMM) probing error. These tests are similar to those provided for a single-stylus contacting probing system in ISO 10360-2:2001. As the revised version of ISO 10360-2 (ISO 10360-2:2009) does not include these tests, similar tests are being temporarily provided in this Publicly Available Specification. When ISO 10360-5:2000 is revised, it will include tests for a single-stylus contacting probing system.

Geometrical product specification (GPS) — Coordinate measuring machines (CMM): Testing the performance of CMMs using single-stylus contacting probing systems

1 Scope

This Publicly Available Specification specifies the acceptance and reverification tests for CMM probing error. It is applicable only to Cartesian CMMs using a single-stylus contacting probing system, discrete-point probing mode, and a spherical or hemispherical stylus.

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*

ISO 14253-1:1998, *Geometrical Product Specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 1: Decision rules for proving conformance or non-conformance with specifications*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
single-stylus form error
P_{FTU}
error of indication within which the range of radii can be determined by a least-squares fit of points measured on a spherical material standard of size, the measurements being taken with a single stylus on the test sphere located anywhere in the measuring volume by a CMM using the discrete-point probing mode

See Figure 15 in ISO 10360-1:2000.

NOTE 1 The character “P” in P_{FTU} indicates that the error is related primarily to the probing-system performance. The character “F” indicates form; the character “T” indicates a tactile probe, and the character “U” indicates use of a single (unique) stylus.

NOTE 2 P_{FTU} is identical to the parameter P in ISO 10360-2:2001.

3.2
single-stylus size error
P_{STU}
error of indication representing the error in the diameter of a least-squares fit of points measured on a spherical material standard of size, the measurements being taken with a single stylus on the test sphere located anywhere in the measuring volume by a CMM using the discrete-point probing mode

NOTE 1 The character "P" in P_{STU} indicates that the error is related primarily to the probing-system performance. The character "S" indicates size; the character "T" indicates a tactile probe, and the character "U" indicates use of a single (unique) stylus.

NOTE 2 P_{STU} is only an informative value used in ISO 10360-2:2001, Annex A.

3.3
maximum permissible single-stylus form error
$P_{FTU, MPE}$
extreme value of the single-stylus form error, P_{FTU}, permitted by specifications, regulations, etc. for a CMM

See Figure 15 in ISO 10360-1:2000.

NOTE $P_{FTU, MPE}$ may be specified by probe tip offset length or stylus system.

4 Symbols

For the purpose of this Publicly Available Specification, the symbols in Table 1 apply.

Table 1 — Symbols

Symbol	Meaning
P_{FTU}	single-stylus form error
P_{STU}	single-stylus size error
$P_{FTU, MPE}$	maximum permissible single-stylus form error

NOTE See Clause 9 for the indications of these symbols in product documentation, drawings, data sheets, etc.

5 Requirements for metrological characteristics

5.1 Single-stylus form error

The single-stylus form error, P_{FTU}, shall not exceed the maximum permissible single-stylus form error, $P_{FTU, MPE}$, as stated by

— the manufacturer, in the case of acceptance tests, or

— the user, in the case of reverification tests.

The single-stylus form error, P_{FTU}, and the maximum permissible single-stylus form error, $P_{FTU, MPE}$, are expressed in micrometres.

5.2 Probing system

The limits of the probing-system configuration (stylus, stylus extensions, stylus orientation, weight of stylus system, etc.) to which the stated value of $P_{\mathrm{FTU,\ MPE}}$ applies shall be stated by

— the manufacturer, in the case of acceptance tests, or

— the user, in the case of reverification tests.

In both cases, the user is free to choose the way in which the components of the probing system are configured within the specified limits.

The form deviation of the stylus tip will influence the measurement results and shall be taken into account when proving conformance or non-conformance with specifications.

Use of a stylus relevant to a typical workpiece measuring task is recommended.

NOTE An articulating probing system used at a single angular position, with a single stylus, is deemed to be a single-stylus probing system.

5.3 Stylus

Any stylus used in the testing specified in Clause 6 shall be one approved by the CMM manufacturer for use with the CMM, i.e. made of the same material, of the same stylus-shaft diameter and nominal length, and having the same stylus-tip quality. However, it is recognised that the exact stylus lengths used for test procedures might not be available; therefore, a stylus-length variation of 6 mm or 10 % of the nominal length, whichever is the greater, may be used.

5.4 Environmental conditions

Limits for permissible environmental conditions such as temperature conditions, air humidity and vibration at the site of installation that influence the measurements shall be specified by

— the manufacturer, in the case of acceptance tests, or

— the user, in the case of reverification tests.

In both cases, the user is free to choose the environmental conditions under which the ISO 10360-5 testing will be performed within the specified limits (the specified limits are given in the manufacturer's data sheet).

The user is responsible for providing the environment enclosing the CMM as specified by the manufacturer in the data sheet. If the environment does not meet the specifications, then none of the maximum permissible errors in this Publicly Available Specification can be required to be verified.

5.5 Operating conditions

For the testing specified in Clause 6, the CMM shall be operated using the procedures given in the manufacturer's operating manual. Specific areas of the manufacturer's operating manual to be adhered to include

a) machine start up/warm up cycles,

b) stylus system configuration and assembly,

c) cleaning procedures for stylus tip, test sphere and reference sphere,

d) probing-system qualification, and

e) when specified by the manufacturer, the position of the reference sphere.