

Geometrical product specifications (GPS) - Acceptance and reverification tests for coordinate measuring systems (CMS) - Part 8: CMMs with optical distance sensors (ISO 10360-8:2013)

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN ISO 10360-8:2013 sisaldab Euroopa standardi EN ISO 10360-8:2013 inglisekeelset teksti.	This Estonian standard EVS-EN ISO 10360-8:2013 consists of the English text of the European standard EN ISO 10360-8:2013.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 04.12.2013.	Date of Availability of the European standard is 04.12.2013.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 17.040.30

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardikeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardikeskusega:
Aru 10, 10317 Tallinn, Eesti; www.evs.ee; telefon 605 5050; e-post info@evs.ee

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation:
Aru 10, 10317 Tallinn, Estonia; www.evs.ee; phone 605 5050; e-mail info@evs.ee

ICS 17.040.30

English Version

Geometrical product specifications (GPS) - Acceptance and
reverification tests for coordinate measuring systems (CMS) -
Part 8: CMMs with optical distance sensors (ISO 10360-8:2013)

Spécification géométrique des produits (GPS) - Essais de
réception et de vérification périodique des systèmes de
mesure tridimensionnels (SMT) - Partie 8: MMT avec
détecteurs optiques sans contact (ISO 10360-8:2013)

Geometrische Produktspezifikation und -prüfung (GPS) -
Annahme- und Bestätigungsprüfung für
Koordinatenmessgeräte (KMG) - Teil 8: KMG mit optischen
Abstandssensoren (ISO 10360-8:2013)

This European Standard was approved by CEN on 16 November 2013.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Foreword

This document (EN ISO 10360-8:2013) 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.

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 June 2014, and conflicting national standards shall be withdrawn at the latest by June 2014.

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.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Endorsement notice

The text of ISO 10360-8:2013 has been approved by CEN as EN ISO 10360-8:2013 without any modification.

Contents

	Page
Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 Symbols	9
5 Requirements for metrological characteristics	10
5.1 Environmental conditions.....	10
5.2 Operating conditions.....	10
5.3 Probing form error.....	11
5.4 Probing dispersion value.....	11
5.5 Probing size error.....	11
5.6 Probing size error All.....	11
5.7 Length measurement error.....	12
5.8 Flat form measurement error.....	12
5.9 Workpiece loading effects.....	12
6 Acceptance tests and reverification tests	13
6.1 General.....	13
6.2 Probing characteristics.....	13
6.3 Length measurement error.....	20
6.4 Flat form measurement error.....	23
7 Compliance with specifications	26
7.1 Acceptance test.....	26
7.2 Reverification test.....	27
8 Applications	28
8.1 Acceptance test.....	28
8.2 Reverification test.....	28
8.3 Interim check.....	28
9 Indication in product documentation and data sheets	28
Annex A (informative) Structural resolution test	29
Annex B (normative) Artefacts that represent a calibrated test length	34
Annex C (informative) Alignment of artefacts	44
Annex D (normative) Articulated location value of CMMs with articulating probing system for optical distance sensors	46
Annex E (informative) Relation to the GPS matrix model	49
Bibliography	51

Introduction

This part of ISO 10360 is a geometrical product specification (GPS) standard and is to be regarded as a general GPS standard (see ISO/TR 14638). It influences link 5 of the chains of standards on size, distance, radius, angle, form, orientation, location, run-out and datums. For more detailed information of the relation of this part of ISO 10360 to other standards and the GPS matrix model, see [Annex E](#).

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.

The tests of this part of ISO 10360 have two technical objectives:

- a) to test the error of indication of a calibrated test length using an optical distance sensor and
- b) to test the errors of the optical distance sensor.

Optical distance sensors treated in this standard are classified into two types,

- point measuring sensors, and
- area measuring sensors (e.g. laser point scan, laser line scan, fringe projection)

The benefits of these tests are that the measured result has a direct traceability to the unit length, the metre, and that it gives information on how the CMM (coordinate measuring machine) will perform on similar length measurements.

This part of ISO 10360 parallels that of ISO 10360-2 and ISO 10360-5, which is for CMMs equipped with contact probing systems. The testing methodology between these three parts of ISO 10360 is designed to be intentionally similar. The differences that exist may be eliminated in future revisions of this part or in ISO 10360-2.

Geometrical product specifications (GPS) — Acceptance and reverification tests for coordinate measuring systems (CMS) —

Part 8: CMMs with optical distance sensors

1 Scope

This part of ISO 10360 specifies the acceptance tests for verifying the performance of a CMM (coordinate measuring machine) when measuring lengths as stated by the manufacturer. It also specifies the reverification tests that enable the user to periodically reverify the performance of the CMM. The acceptance and reverification tests given in this part of ISO 10360 are applicable only to Cartesian CMMs with optical distance sensors. This standard does not explicitly apply to non-Cartesian CMMs, however, the parties may apply this part of 10360 to non-Cartesian CMMs by mutual agreement.

NOTE This part of ISO 10360 is not intended to apply for CMMs whose measuring volume is significantly smaller than the size of the test sphere, however, the principle, artefacts, and procedure of the test described in this part of ISO 10360 are useful for the acceptance and reverification tests of those CMMs either as it is or with modifying the parameters such as the size of the test artefacts and the number of the measurements.

This part of ISO 10360 specifies:

- performance requirements that can be assigned by the manufacturer or the user of the CMM,
- the manner of execution of the acceptance and reverification tests to demonstrate the stated requirements,
- rules for verifying conformance, and
- applications for which the acceptance and reverification tests can be used.

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 10360-2:2009, *Geometrical product specifications (GPS) — Acceptance and reverification tests for coordinate measuring machines (CMM) — Part 2: CMMs used for measuring linear dimensions*

ISO 10360-5:2010, *Geometrical product specifications (GPS) — Acceptance and reverification tests for coordinate measuring machines (CMM) — Part 5: CMMs using single and multiple stylus contacting probing systems*

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

ISO/TS 23165:2006, *Geometrical product specifications (GPS) — Guidelines for the evaluation of coordinate measuring machine (CMM) test uncertainty*

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 part of ISO 10360, the terms and definitions given in ISO 10360-1, ISO 14253-1 and ISO/IEC Guide 99 and the following apply.

3.1 optical distance sensor

non-contacting probing system which determines a corrected measured point by means of optical distance measurement principle

Note 1 to entry: Typical measurement principles are triangulation and coaxial distance measurement. The former includes structured line projection, Moiré, slit light projection, point scanning, etc., and the latter includes interferometry and confocal systems.

3.2 local test flat

flat form standard used for evaluating the probing form error when testing the probing performance

Note 1 to entry: A local test flat is used in addition to the test sphere which is used for evaluating both the probing form and probing size errors.

Note 2 to entry: A local test flat is useful for testing probing performance when a calibrated test sphere with larger size suitable for an optical distance sensor with larger sensor area is practically difficult to obtain. [Figure 5](#) shows a flow chart for material standard selection.

3.3 global test flat

flat form standard used when testing the flat form measurement error

Note 1 to entry: Global test flat is intended and encouraged to test form measuring performance of a CMM equipped with an optical distance sensor when the system is used for measuring a larger area than the sensor area.

3.4 sensor area

area illuminated by the optical distance sensor when a two-dimensional image-projection-type sensor is used

Note 1 to entry: The sensor area is determined not only by the length of the projection line of the sensor but also by the length of the sensor movement realized by the CMM when line scan or point scan sensors are used.

See [Figure 1](#).