

SLOVENSKI STANDARD

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Specifikacija geometrijskih veličin izdelka (GPS) - Preskusi za sprejemljivost in ponovno overjanje koordinatnih merilnih strojev (KMS) - 10. del: Laserski 3D merilniki (ISO 10360-10:2021)

Geometrical product specifications (GPS) - Acceptance and reverification tests for coordinate measuring systems (CMS) - Part 10: Laser trackers (ISO 10360-10:2021)

Geometrische Produktspezifikationen (GPS) - Annahmeprüfung und Bestätigungsprüfung für Koordinatenmessgeräte (KMG) - Teil 10: Lasertracker für Punkt-zu-Punkt-Messungen (ISO 10360-10:2021)

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Spécification géométrique des produits (GPS) - Essais de réception et de vérification périodique des systèmes à mesurer tridimensionnels (SMT) - Partie 10: Laser de poursuite (ISO 10360-10:2021)

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31.260	Optoelektronika, laserska oprema	Optoelectronics. Laser equipment

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NORME EUROPÉENNE
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English Version

Geometrical product specifications (GPS) - Acceptance and reverification tests for coordinate measuring systems (CMS) - Part 10: Laser trackers (ISO 10360-10:2021)

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This European Standard was approved by CEN on 21 August 2021.

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COMITÉ EUROPÉEN DE NORMALISATION
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European foreword

This document (EN ISO 10360-10:2021) 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of an identical text or by endorsement, at the latest by March 2022, and conflicting national standards shall be withdrawn at the latest by March 2022.

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

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Any feedback and questions on this document should be directed to the users' national standards body/national committee. A complete listing of these bodies can be found on the CEN websites.

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, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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The text of ISO 10360-10:2021 has been approved by CEN as EN ISO 10360-10:2021 without any modification.

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INTERNATIONAL
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ISO
10360-10

Second edition
2021-08

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

**Part 10:
Laser trackers**

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*Spécification géométrique des produits (GPS) — Essais de réception
et de vérification périodique des systèmes à mesurer tridimensionnels
(SMT) —*

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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 (see 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 (see 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 of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 213, *Dimensional and geometrical product specifications and verification*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 290, *Dimensional and geometrical product specification and verification*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 10360-10:2016), which has been technically revised.

The main changes to the previous edition are as follows:

- the number of lengths tested has been reduced;
- user-selectable positions for two-face testing have been added;
- more guidance on interim testing has been added;
- symbol E_{Uni} revised to E_{Vol} .

A list of all parts in the ISO 10360 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document is a geometrical product specification (GPS) standard and is to be regarded as a general GPS standard (see ISO 14638). It influences chain link F of the chain of standards on size, distance, form, orientation, location and run-out.

The ISO/GPS matrix model given in ISO 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.

More detailed information on the relation of this document to other standards and the GPS matrix model can be found in [Annex H](#).

The objective of this document is to provide a well-defined testing procedure for:

- a) laser tracker manufacturers to specify performance by maximum permissible errors (MPEs); and
- b) to allow testing of these specifications using calibrated and traceable test lengths, test spheres and flats.

The benefits of these tests are that the measured result has a direct traceability to the unit of length, the metre, and that it gives information on how the laser tracker will perform on similar length measurements.

This document is distinct from ISO 10360-2, which is for coordinate measuring machines (CMMs) equipped with contact probing systems, in that the orientation of the calibrated test lengths reflects the different instrument geometry and error sources within the instrument.

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

Part 10: Laser trackers

1 Scope

This document specifies the acceptance tests for verifying the performance of a laser tracker by measuring calibrated test lengths, according to the specifications of the manufacturer. It also specifies the reverification tests that enable the user to periodically reverify the performance of the laser tracker. The acceptance and reverification tests given in this document are applicable to laser trackers utilizing a retroreflector, or a retroreflector in combination with a stylus or optical distance sensor, as a probing system. Laser trackers that use interferometric measurement (IFM), absolute distance measurement (ADM) or both can be verified using this document. This document can also be used to specify and verify the relevant performance tests of other spherical coordinate measurement systems that use cooperative targets, such as “laser radar” systems.

NOTE Systems which do not track the target, such as laser radar systems, will not be tested for probing performance.

This document does not explicitly apply to measuring systems that do not use a spherical coordinate system. However, interested parties can apply this document to such systems by mutual agreement.

This document specifies:

- performance requirements that can be assigned by the manufacturer or the user of the laser tracker;
- the manner of execution of the acceptance and reverification tests to demonstrate the stated requirements;
- rules for proving conformity;
- applications for which the acceptance and reverification tests can be used.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 10360-8:2013, *Geometrical product specifications (GPS) — Acceptance and reverification tests for coordinate measuring systems (CMS) — Part 8: CMMs with optical distance sensors*

ISO 10360-9:2013, *Geometrical product specifications (GPS) — Acceptance and reverification tests for coordinate measuring systems (CMS) — Part 9: CMMs with multiple probing systems*

3 Terms and definitions

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

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ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1

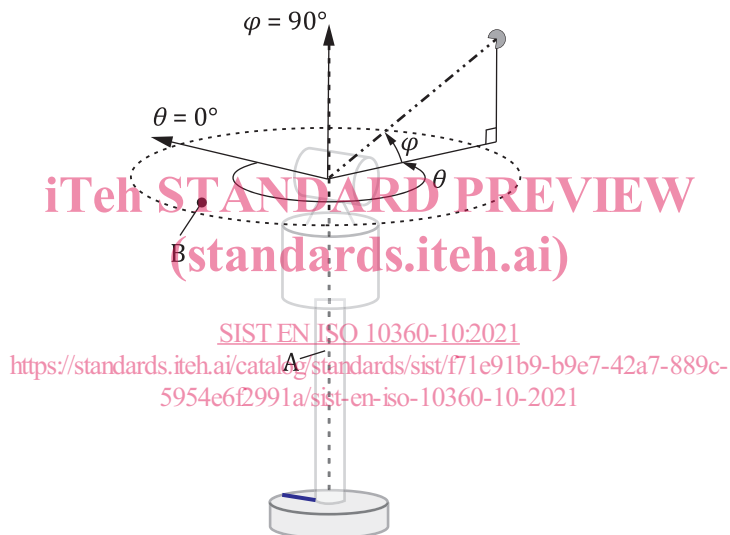
laser tracker

coordinate measuring system in which a cooperative target is followed with a laser beam and its location determined in terms of a distance (range) and two angles

Note 1 to entry: The two angles are referred to as azimuth, θ , (rotation about a vertical axis – the standing axis of the laser tracker) and either elevation, φ , (angle above a horizontal plane – perpendicular to the standing axis) or zenith (angle from the standing axis).

Note 2 to entry: Care should be used with the symbols associated with spherical coordinate systems, as different conventions exist. For example, the description of a spherical coordinate system in ISO 80000-2 uses the symbols differently and uses the zenith angle (away from vertical) rather than elevation.

Note 3 to entry: See [Figure 1](#)



Key

- A standing axis
- B horizontal plane (of the laser tracker)
- θ azimuth angle
- φ elevation angle

Figure 1 — Coordinate system of a laser tracker

3.2

interferometric measurement mode

IFM mode

measurement method that uses a laser displacement interferometer integrated in a *laser tracker* ([3.1](#)) to determine distance (range) to a target

Note 1 to entry: Displacement interferometers can only determine differences in distance, and therefore require a reference distance (e.g. home position).

3.3 absolute distance measurement mode ADM mode

measurement method that uses time of flight instrumentation integrated in a *laser tracker* (3.1) to determine the distance (range) to a target

Note 1 to entry: Time of flight instrumentation may include a variety of modulation methods to calculate the distance to the target.

3.4 retroreflector

passive device designed to reflect light back parallel to the incident direction over a range of incident angles

Note 1 to entry: Typical retroreflectors are the cat's-eye, the cube corner and spheres of special material.

Note 2 to entry: Retroreflectors are cooperative targets.

Note 3 to entry: For certain systems, for example laser radar, the retroreflector will possibly be a cooperative target such as a polished sphere.

3.5 spherically mounted retroreflector SMR

retroreflector (3.4) that is mounted in a spherical housing

Note 1 to entry: In the case of an open-air cube corner, the vertex is typically adjusted to be coincident with the sphere centre.

Note 2 to entry: The tests in this document are typically executed with a spherically mounted retroreflector.

Note 3 to entry: See [Figure 2](#). [SIST EN ISO 10360-10:2021
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3.6 stylus and retroreflector combination SRC

probing system that determines the measurement point utilizing a probe stylus to contact the workpiece, a *retroreflector* (3.4) to determine the base location of the probe, and other means to find the stylus orientation unit vector

Note 1 to entry: The datum for the stylus tip offset (l) is the centre of the retroreflector.

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