INTERNATIONAL STANDARD

ISO 12179

Second edition
2021-12

Geometrical product specifications (GPS) — Surface texture: Profile method — Calibration of contact (stylus) instruments

Spécification géométrique des produits (GPS) — État de surface: Méthode du profil — Étalonnage des instruments à contact (palpeur)

Reference number
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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).

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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 12179:2000), which has been technically revised. It also incorporates Technical Corrigendum ISO 12179:2000/Cor. 1:2003.

The main changes to the previous edition are as follows:

— Annex C has been amended.

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 G of the chain of standards on profile surface texture.

The ISO GPS matrix model is given in ISO 14638, For more detailed information on the relationship of this document to the GPS matrix model, see Annex F. An overview of standards on profiles and areal surface texture is given in Annex E.

This document introduces calibration of contact (stylus) instruments as defined in ISO 3274. The calibration is carried out with the aid of measurement standards.

Geometrical product specifications (GPS) — Surface texture: Profile method — Calibration of contact (stylus) instruments

1 Scope

This document specifies the calibration and adjustment of the metrological characteristics of contact (stylus) instruments for the measurement of surface texture by the profile method as defined in ISO 3274. The calibration and adjustment is intended to be carried out with the aid of measurement standards.

Annex B specifies the calibration and adjustment of metrological characteristics of simplified operator contact (stylus) instruments which do not conform with ISO 3274.

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 3274, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Nominal characteristics of contact (stylus) instruments*

ISO 5436-1:2000, *Geometrical Product Specifications (GPS) — Surface texture: Profile method; Measurement standards — Part 1: Material measures*

ISO 10012, *Measurement management systems — Requirements for measurement processes and measuring equipment*

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

ISO 14253-2, *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 21920-2, *Geometrical product specifications (GPS) — Surface texture: Profile — Part 2: Terms, definitions and surface texture parameters*

ISO 25178-73, *Geometrical product specifications (GPS) — Surface texture: Areal — Part 73: Terms and definitions for surface defects on material measures*

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 3274, ISO 14253-1, ISO 21920-2, GUM and VIM and the following apply.

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
calibration
operation that, under specified conditions:

a) in a first step, establishes a relation between the quantity values with measurement uncertainties provided by measurement standards and corresponding indications with associated measurement uncertainties; and

b) in a second step, uses this information to establish a relation for obtaining a measurement result from an indication

[SOURCE: ISO/IEC Guide 99:2007 (VIM), 2.39, modified — Notes to entry removed.]

3.2
task-related calibration
set of operations which establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument and the corresponding known values of a limited family of precisely defined measurands which constitute a subset of the measuring capabilities of the measuring instrument

3.3
adjustment
adjustment of a measuring system
set of operations carried out on a measuring system so that it provides prescribed indications corresponding to given values of a quantity to be measured

[SOURCE: ISO/IEC Guide 99:2007 (VIM), 3.11, modified — Notes to entry removed.]

3.4
measurement standard
etalon
realization of the definition of a given quantity, with stated quantity value and associated measurement uncertainty, used as a reference

Note 1 to entry: Measurement standards are also referred to as “calibration specimens”.

[SOURCE: ISO/IEC Guide 99:2007 (VIM), 5.1, modified — Examples and Notes to entry removed.]

3.5
measurement uncertainty
uncertainty of measurement
uncertainty
non-negative parameter characterizing the dispersion of the quantity values being attributed to a measurand, based on the information used

[SOURCE: ISO/IEC Guide 99:2007 (VIM), 2.26, modified — Notes to entry removed.]

3.6
metrological traceability
property of a measurement result whereby the result can be related to a reference through a documented unbroken chain of calibrations, each contributing to the measurement uncertainty

[SOURCE: ISO/IEC Guide 99:2007 (VIM), 2.41, modified — Notes to entry removed.]

3.7
defect
<material measures> part of the measurement standard's geometrical feature (non-ideal surface) on which the geometrical shape and geometrical dimensions deviate from those on the nominal feature (ideal surface) either by an amount greater than some agreed or stated maximum value, or, in the absence of any such agreed or stated maximum value, by an amount greater than what is typical or characteristic for the processes used in manufacturing the measurement standard

[SOURCE: ISO 25178-73:2019, 3.1.2, modified — Notes to entry removed.]

4 Conditions of use

4.1 Components and configurations of the contact (stylus) instrument

The contact (stylus) instrument comprises the basic equipment, a drive unit, a probe and a profile recorder (see ISO 3274). If the basic equipment is used with several drive units and probes, each of these instrumental combinations (configurations) shall be calibrated separately.

4.2 Calibration of a configuration

The contact (stylus) instrument shall be calibrated when a change is made to the basic elements of the system which intentionally or unintentionally modifies the measured profile or measuring result. Each configuration of the contact (stylus) instrument shall be calibrated separately. For example, with a change of probe, the contact (stylus) instrument is calibrated.

4.3 Place of calibration

The contact (stylus) instrument should be calibrated at the place of use with environmental conditions similar to those present when in use for measurement to take into account external influence factors.

EXAMPLES Noise, temperature, vibration, air movement.

4.4 Defects

Geometrical defects that can be present on the surfaces of material measures and calibration specimens shall be taken into consideration according to ISO 25178-73.

5 Measurement standards

The following measurement standards are applicable to the calibrations given in Clause 6:

— optical flat;

— depth measurement standard (see Figure 1): type A according to ISO 5436-1:2000;

— spacing measurement standard (see Figure 2): type C according to ISO 5436-1:2000;

— inclined optical flat (see Figure 3);

— profile coordinate measurement standard (consisting of a sphere or prism): type E according to ISO 5436-1:2000;

— roughness measurement standard (see Figure 4): type D according to ISO 5436-1:2000.

It is recommended that a profile coordinate measurement standard be used on contact (stylus) instruments where the stylus rotates at least plus and minus one half of a degree when moving through its full range.

NOTE A type C periodic measurement standard is also useful for checking *Ra* as well as for checking *Rsm*.

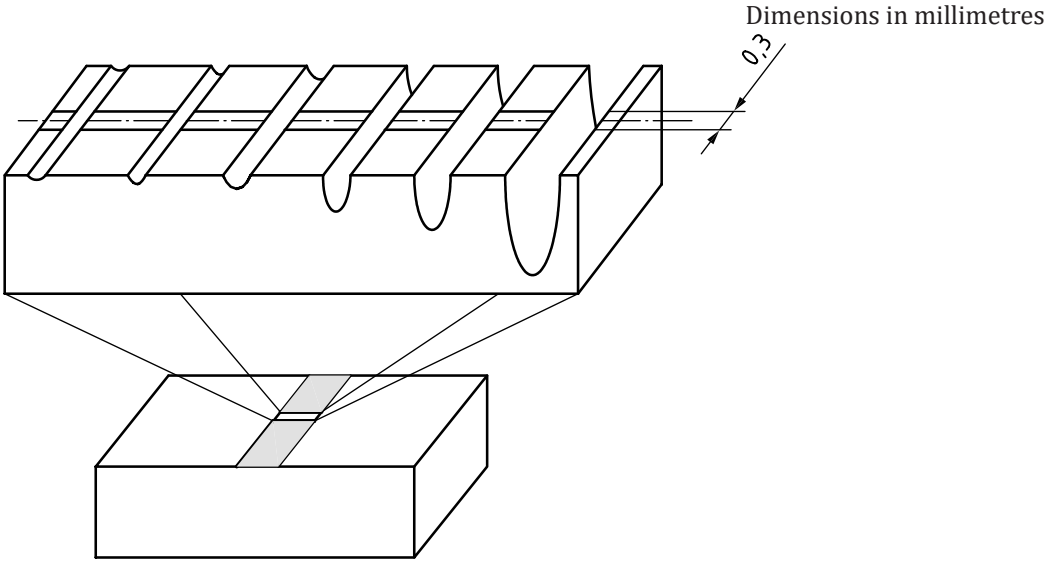

Figure 1 — Example of a depth measurement standard (type A)

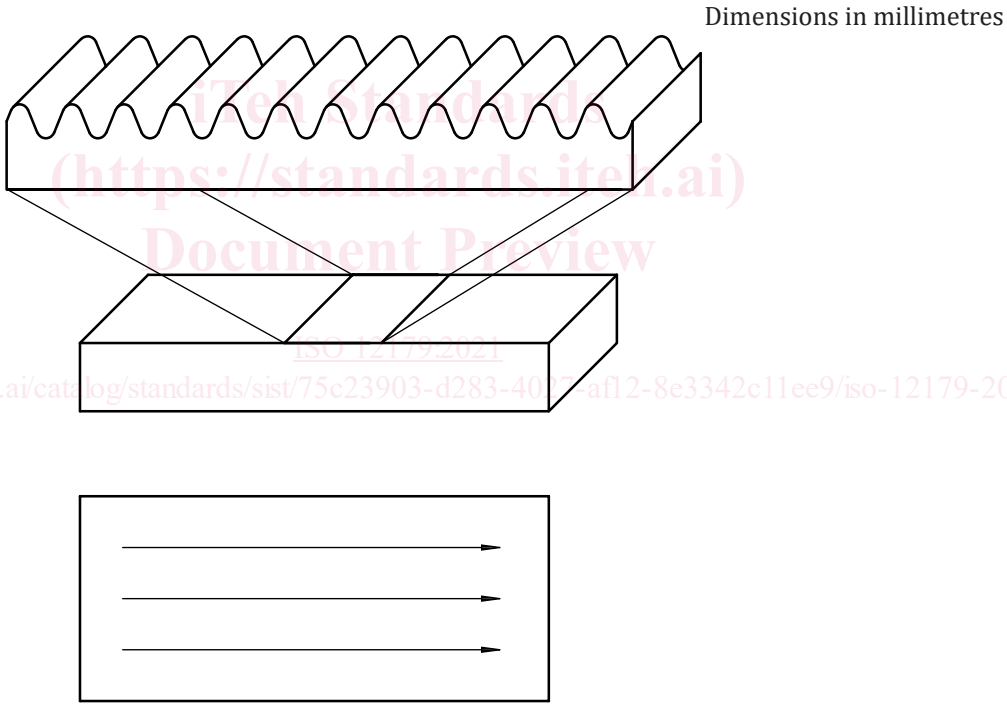

Figure 2 — Example of a spacing measurement standard (type C)

Dimensions in millimetres

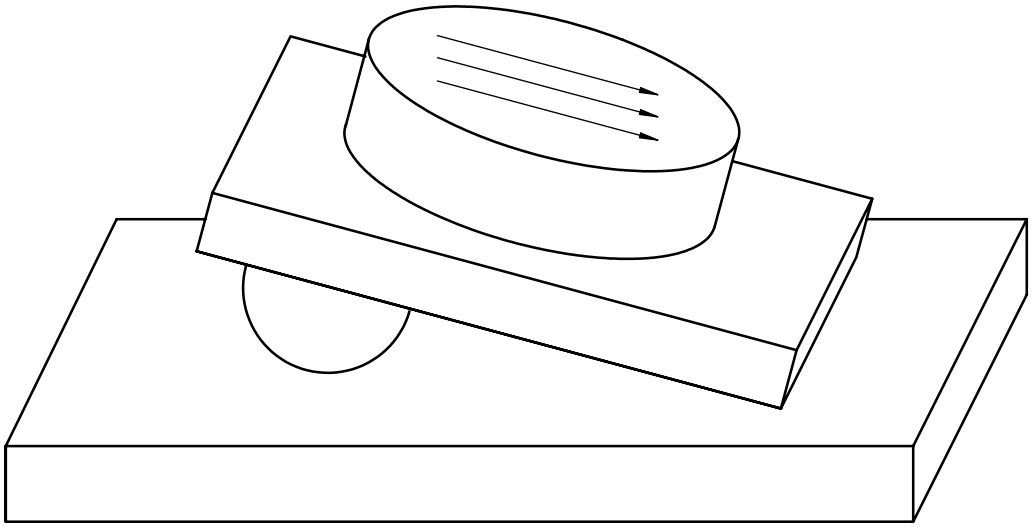

Figure 3 — Example of an inclined optical flat and a measuring plan

Dimensions in millimetres

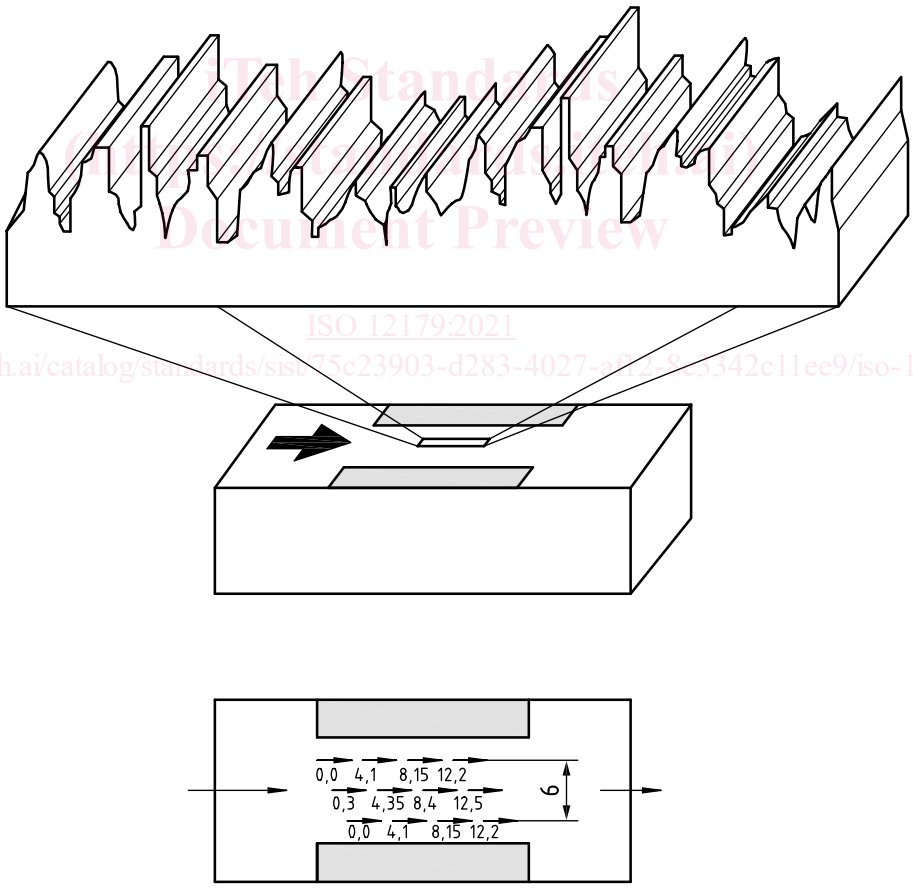

Figure 4 — Example of a roughness measurement standard (type D) and measuring plan