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**Geometrical product specifications  
(GPS) — Standard reference  
temperature for the specification  
of geometrical and dimensional  
properties**

*Spécification géométrique des produits (GPS) — Température  
normale de référence pour la spécification des propriétés  
géométriques et dimensionnelles*





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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](http://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](http://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 World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

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

This third edition cancels and replaces the second edition (ISO 1:2002), which has been technically revised. Specifically, the following points have changed:

- the standard reference temperature definition has been included; consequently, the title, introduction and scope, have been changed;
- the general definition of reference temperature has been included.

## Introduction

This International Standard is a geometrical product specification (GPS) standard and is to be regarded as a fundamental GPS Standard (see ISO 14638:2015<sup>[1]</sup>). For more detailed information on the relationship of this International Standard to other standards and the GPS matrix model, see [Annex B](#).

The definitions of the units, including those of length and temperature, are adopted by the General Conference of Weights and Measures (CGPM) under the authority of the Convention of the Metre. These definitions are maintained in the SI brochure.<sup>[5]</sup>

The unit of length, the metre, is independent of temperature. The current definition of the metre<sup>[6]</sup> is based on the distance light travels in vacuum during a unit of time. However, a physical object is subject to thermal expansion and consequently, its geometrical and dimensional properties are dependent on its temperature. Specifying a reference temperature allows the geometrical and dimensional properties of a physical object to be unambiguously stated.

# Geometrical product specifications (GPS) — Standard reference temperature for the specification of geometrical and dimensional properties

## 1 Scope

This International Standard defines the concepts of a reference temperature and of the standard reference temperature, and specifies the standard reference temperature value for the specification of geometrical and dimensional properties of an object. Some examples of geometrical and dimensional properties include size, location, orientation (including angle), form and surface texture of a workpiece.

This International Standard is also applicable to the definition of the measurand used in verification or calibration.

## 2 Terms and definitions

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

### 2.1

#### **reference temperature**

temperature of an object, having a uniform temperature, specified as part of the definition of a geometrical or dimensional property

Note 1 to entry: The specification of a geometrical or dimensional property is typically given in technical product documentation, e.g., on an engineering drawing or in a CAD file, or in the specification of the measurand (the quantity intended to be measured).

### 2.2

#### **standard reference temperature**

internationally agreed-upon reference temperature

Note 1 to entry: In prior editions of this International Standard, the term “standard reference temperature” was defined as its assigned numerical value, i.e. 20 °C. In this edition, the definition of the *reference temperature* (2.1) and the assignment of a standardized value to this temperature are separately addressed (Clause 3).

## 3 Standard reference temperature value for the specification of geometrical and dimensional properties

The standard reference temperature value for the specification of geometrical and dimensional properties shall be fixed at 20 °C. Unless otherwise explicitly specified, the reference temperature for geometrical and dimensional properties of workpieces shall be the standard reference temperature. See Annex A for information on the use of the reference temperature specification.

NOTE 1 There is only one standard reference temperature value and it is fixed at 20 °C. However, this does not prevent a different (non-standard) reference temperature from being specified for all geometrical and dimensional properties of a workpiece or for a specific geometrical or dimensional property on a workpiece, provided it is explicitly stated as part of the specification.

NOTE 2 The specification of a non-standard reference temperature may increase the measurement uncertainty during verification because most dimensional measuring equipment and gauges are calibrated with their measurand defined at the standard reference temperature.

## Annex A (informative)

### Use of the reference temperature specification

Specifying geometrical and dimensional properties at a single temperature value can raise questions since

- a) the functional requirements of any physical workpiece include other temperatures,
- b) verification cannot physically occur at an exact, uniform temperature.

Regarding the issue that workpiece functional requirements include other temperatures, it is important to note that a designer typically specifies not only the requirements on the geometric and dimensional properties of the workpiece (usually at the standard reference temperature value), but also separate requirements on the material properties of the workpiece. Combining the knowledge of how a specified material behaves at different temperatures and the specified geometric and dimensional properties at a single temperature can allow a designer to ensure a workpiece will meet geometric and dimensional functional requirements over a range of temperatures.

Regarding the issue that any geometrical or dimensional verification inevitably occurs at a temperature different than the reference temperature, an adequate correction for that difference is necessary (see for example ISO/IEC Guide 99:2007, 2.3, Note 3<sup>[2]</sup>). In some cases, the correction might be zero (i.e. no correction is performed); however, in all cases, it is necessary that the lack of knowledge of the exact correction be accounted for appropriately in the measurement uncertainty [see for example ISO/IEC GUIDE 98-3:2008, 3.3.2 b)<sup>[3]</sup>].

Most measuring systems are designed to produce measurement results specified at the standard reference temperature value of 20 °C even though they may be operating at a different temperature. In this case, deviations from the standard reference temperature for either the measuring system or the workpiece under measurement lead to additional measurement uncertainty contributors; see ISO/TR 16015<sup>[4]</sup> for additional information. The term reference temperature should not be confused with the term rated operating condition.

## Annex B (informative)

### Relation to the GPS matrix model

#### B.1 General

The ISO GPS matrix model given in ISO 14638 gives an overview of the ISO GPS system of which this standard is a part.

#### B.2 Information about this International Standard and its use

This International Standard is used whenever GPS specifications for workpieces and measuring equipment are given. It constitutes the basis for the evaluation of measurement uncertainty.

#### B.3 Position in GPS matrix model

This standard is a fundamental GPS standard. The rules and principles given in this standard apply to all general and complementary ISO GPS standards in the ISO GPS matrix. See [Table B.1](#).

**Table B.1 — Position in the GPS matrix model**

	Chain links						
	A	B	C	D	E	F	G
	Symbols and indications	Feature requirements	Feature properties	Conformance and non-conformance	Measurement	Measurement equipment	Calibrations
Size	•	•	•	•	•	•	•
Distance	•	•	•	•	•	•	•
Form	•	•	•	•	•	•	•
Orientation	•	•	•	•	•	•	•
Location	•	•	•	•	•	•	•
Run-out	•	•	•	•	•	•	•
Profile surface texture	•	•	•	•	•	•	•
Areal surface texture	•	•	•	•	•	•	•
Surface imperfections	•	•	•	•	•	•	•

#### B.4 Related International Standards

The related standards are those of the chains of standards indicated in [Table B.1](#).



## Bibliography

- [1] ISO 14638, *Geometrical product specifications (GPS) — Matrix model*
- [2] ISO/IEC Guide 99:2007, *International vocabulary of metrology — Basic and general concepts and associated terms (VIM)*
- [3] ISO/IEC Guide 98-3:2008, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*
- [4] ISO/TR 16015, *Geometrical product specifications (GPS) — Systematic errors and contributions to measurement uncertainty of length measurement due to thermal influences*
- [5] *SI Brochure: The International System of Units (SI)*. 8th Edition, 2006; updated in 2014. Bureau International des Poids et Mesures (BIPM)
- [6] 17e Conférence Générale des Poids et Mesures (1983), *Comptes Rendus*. p. 97 (Resolution 1). Bureau International des Poids et Mesures (BIPM), 1984

