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Specifikacija geometrijskih veličin izdelka - Tolerance dimenzij - 1. del: Dolžinske mere (ISO/DIS 14405-1:2024)

Geometrical product specifications (GPS) - Dimensional tolerancing - Part 1: Linear sizes (ISO/DIS 14405-1:2024)

Geometrische Produktspezifikation (GPS) - Dimensionelle Tolerierung - Teil 1: Lineare Größenmaße (ISO/DIS 14405-1:2024)

Spécification géométrique des produits (GPS) - Tolérancement dimensionnel - Partie 1: Tailles linéaires (ISO/DIS 14405-1:2024)

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17.040.40	Specifikacija geometrijskih veličin izdelka (GPS)	Geometrical Product Specification (GPS)

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DRAFT International Standard

ISO/DIS 14405-1

Geometrical product specifications (GPS) — Dimensional tolerancing —

Part 1: Linear sizes

*Spécification géométrique des produits (GPS) — Tolérancement
dimensionnel —*

Partie 1: Tailles linéaires

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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.

This third edition cancels and replaces the second edition (ISO 14405-1:2016), which has been technically revised.

The main changes are as follows:

- the use of linear size specifications for cones, torus and two opposite circles is now reduced to the cases described in [Annexes C, D and E](#);
- the syntax is changed, and is now defined with several indication areas, and a sequence of specification elements in each area;
- linear size specifications can be stacked and the rules for stacked specifications are defined;
- the indication $k\times/n\times$ is now possible, in order to facilitate stacking with geometrical specifications;
- the graphical rules are modified;
- the specification element “/0” to mean “any restricted portion whose length is equal to zero” has been removed to use the “ACS” modifier;
- when different specification operators applied for the upper and the lower limit of size characteristic, the new rule is to indicate two different size specifications;
- the indication of several linear specifications on the same dimension line or reference line with brackets is removed;
- it is now mandatory to use the between symbol to indicate a fixed restricted portion of a feature of size;
- it is now mandatory to indicate SCS with the identifier of the section for a specific cross section;

A list of all parts in the ISO 14405 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.

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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 links A to C of the chain of standards on size.

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 the specifications made in accordance with this document, unless otherwise indicated.

For more detailed information of the relation of this document to other standards and the GPS matrix model, see [Annex I](#).

This document deals with linear size specifications on the following features of linear size:

- cylinders,
- spheres,
- two parallel opposite planes.

It also deals with the following cases: circles as sections of a cone, circles as sections of a torus, parallel opposite lines as longitudinal sections of cylindrical tubes.

Different specification elements allow specifying local linear sizes or global linear sizes of different types, and e.g. specifications on several features, specifications in sections, specifications on portions. The many specification elements allow specifying a variety of functional needs.

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Geometrical product specifications (GPS) — Dimensional tolerancing —

Part 1: Linear sizes

IMPORTANT — The illustrations included in this document are intended to illustrate the text and/or to provide examples of the related technical drawing specification. These illustrations are not fully dimensioned and toleranced showing only the relevant general principles. As a consequence, the illustrations are not a representation of a complete workpiece and are not of a quality that is required for use in industry (in terms of full conformity with the standards prepared by ISO/TC 10 and ISO/TC 213) and as such, are not suitable for projection for teaching purposes. Figures are simplified 2D representations and show features that are unlikely, e.g. a minimum circumscribed cylinder with 3 contact points in the same section.

1 Scope

This document establishes the default specification operator (see ISO 17450-2) and defines a special specification operator for linear sizes. It applies to the following features of linear size:

- cylinders,
- spheres,
- two parallel opposite planes.

[Annex C](#) handles the definition of sizes for circles as sections of a cone. [Annex D](#) handles the definition of sizes for circles as sections of a torus. [Annex E](#) handles the definition of sizes for parallel opposite lines as longitudinal sections of cylindrical tubes in half planes containing a specified axis.

This part of ISO 14405 provides a set of tools to express several types of linear size characteristics. It does not present any information on the relationship between a function or a use and a linear size characteristic.

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 286-1, *Geometrical product specifications (GPS) — ISO code system for tolerances on linear sizes — Part 1: Basis of tolerances, deviations and fits*

ISO 8015, *Geometrical product specifications (GPS) — Fundamentals — Concepts, principles and rules*

ISO 14405-2:2018, *Geometrical product specifications (GPS) — Dimensional tolerancing — Part 2: Dimensions other than linear or angular sizes*

ISO 16610 (all parts), *Geometrical product specifications (GPS) — Filtration*

ISO 17450-1:2011, *Geometrical product specifications (GPS) — General concepts — Part 1: Model for geometrical specification and verification*

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ISO 17450-2:2012, *Geometrical product specifications (GPS) — General concepts — Part 2: Basic tenets, specifications, operators, uncertainties and ambiguities*

ISO 17450-3, *Geometrical product specifications (GPS) — General concepts — Part 3: Toleranced features*

ISO 25378:2011, *Geometrical product specifications (GPS) — Characteristics and conditions — Definitions*

ISO 81714-1, *Design of graphical symbols for use in the technical documentation of products — Part 1: Basic rules*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 286-1, ISO 8015, ISO 17450-1, ISO 17450-2, ISO 17450-3 and the following apply.

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

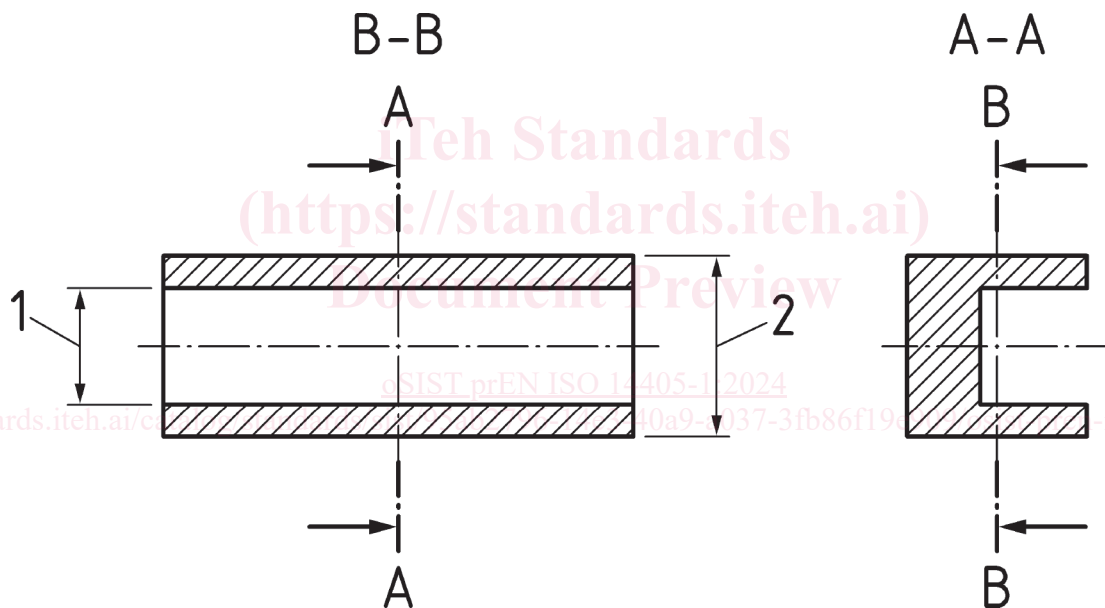
- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

feature of size

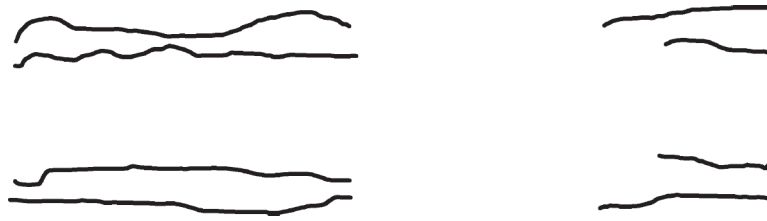
feature of linear size or feature of angular size

Note 1 to entry: [Figures 1](#) and [2](#) illustrate features of linear size, type two parallel opposite planes and type cylinder.



a) Nominal features of linear size (internal and external)

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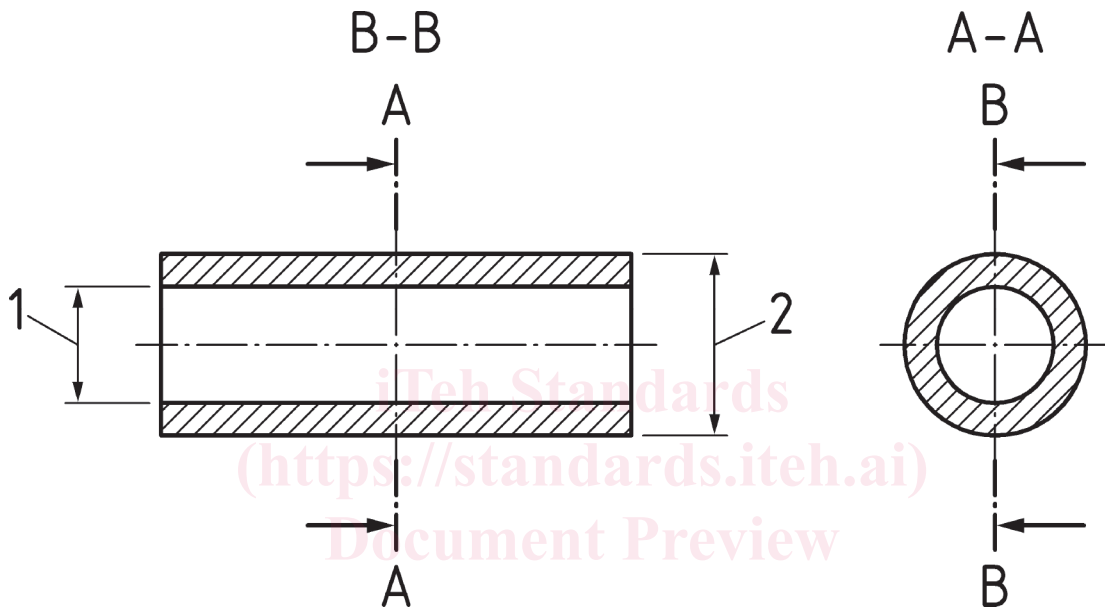


b) Extracted features

Key

- 1 size of the internal feature of linear size
- 2 size of the external feature of linear size

Figure 1 — Examples of features of linear size consisting of two parallel opposite planes



a) Nominal features of linear size (internal and external)



b) Extracted features

Key

- 1 size of the internal feature of linear size
- 2 size of the external feature of linear size

Figure 2 — Examples of features of linear size consisting of a cylinder

[SOURCE: ISO 17450-1:2011, 3.3.1.5, modified – Note 1 to entry, [Figures 1](#) and [2](#) have been added.]

3.2

upper limit of size characteristic

largest permissible value for a *size characteristic* ([3.6](#))

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3.3

lower limit of size characteristic

smallest permissible value for a *size characteristic* (3.6)

3.4

size

dimensional parameter considered variable for a *feature of size* (3.1) that can be defined on a nominal feature or on an associated feature

Note 1 to entry: A size is angular (e.g. angle of a cone) or linear (e.g. diameter of a cylinder). This document only deals with linear sizes. See ISO 14405-3 for angular sizes.

Note 2 to entry: Depending on the type of feature of linear size, the terms “diameter”, “width”, and “thickness” are synonyms for size.

3.5

linear size

dimension in length units characterizing a feature of size

[SOURCE: ISO 14405-2:2018, 3.2]

3.6

size characteristic

characteristic relative to a *size* (3.4) and defined from an extracted integral feature

Note 1 to entry: A size can be evaluated by more than one size characteristic (e.g. the two-point diameter or the diameter of the associated feature taken on the extracted feature).

3.7

local (linear) size

size characteristic (3.6) having by definition a non-unique result of evaluation along and/or around a *feature of size* (3.1)

Note 1 to entry: For a given feature, an infinity of local linear sizes exists.

Note 2 to entry: In [Figure 3](#), examples of local linear sizes are shown. These examples do not take into account the *statistical size* (3.8.6).

3.7.1

two-point size

<local linear size> distance between two opposite points on a extracted integral feature of linear size

Note 1 to entry: A two-point size on a cylinder can be called a “two-point diameter”.

Note 2 to entry: A two-point size on two parallel opposite planes can be called a “two-point thickness” or a “two-point width”.

Note 3 to entry: The method establishing a two-point size from any kind of features of size is given in ISO 17450-3.

Note 4 to entry: See [Figure 3](#) b).

3.7.2

section size

global linear size (3.8) for a given section of the extracted integral feature

Note 1 to entry: A section size is a *local linear size* (3.7) because it has by definition different results of evaluation along the *feature of size* (3.1).

Note 2 to entry: On an extracted feature which is a cylinder, it is possible to define an infinite number of cross sections in which the diameter of the associated circle can be defined (with a specific association criterion). This is a section size.

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

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3.7.3

portion size

global linear size (3.8) for a given portion of the extracted feature

Note 1 to entry: A portion size is a *local linear size* (3.7) because it has by definition different results of evaluation along the *feature of size* (3.1).

Note 2 to entry: See Figure 3 e).

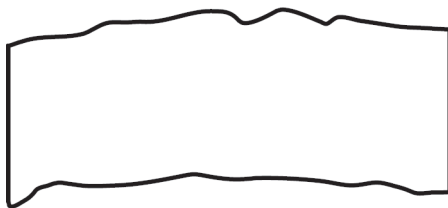
3.7.4

spherical size

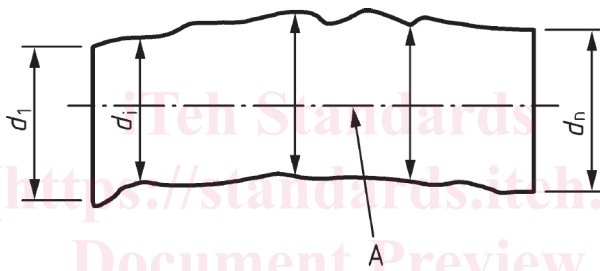
<local linear size> diameter of the maximum inscribed sphere

Note 1 to entry: The maximum inscribed sphere is used when defining the spherical size of both internal and external features of size.

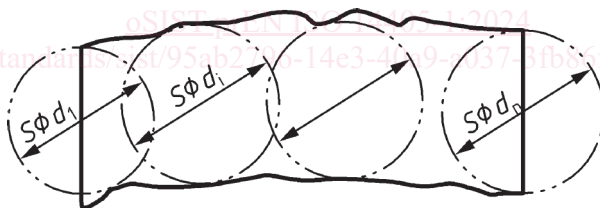
Note 2 to entry: See Figure 3 c).



a) Extracted feature under consideration: cylinder which could be either internal or external



b) Two-point sizes (see ISO 17450-3)

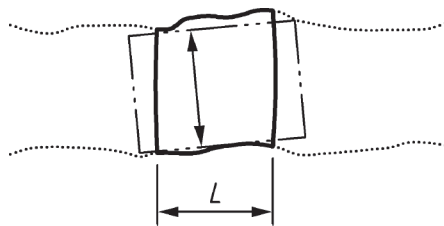


c) Spherical sizes



d) Section size obtained from a global linear size with maximum inscribed criterion (other criteria are possible)

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e) Portion size obtained from a global linear size with maximum inscribed criterion (other criteria are possible)

Key

d	size [in Figure 3 b)]	A	axis of the least-square cylinder associated with the extracted integral feature
L	considered length of the portion of the cylinder	$S\phi d$	diameter of the maximum inscribed sphere

NOTE 1 The section size of [Figure 3 d\)](#) in each cross section is given by the diameter of the maximum inscribed circle defined in that cross section.

NOTE 2 Only a portion of the extracted feature of length, L , is considered in [Figure 3 e\)](#).

Figure 3 — Examples of local linear sizes

3.8

global (linear) size

size characteristic ([3.6](#)) having by definition a unique value along and around a *feature of size* ([3.1](#))

Note 1 to entry: A global linear size can be for a section, for a portion, or for the whole feature. See *section size* ([3.7.2](#)) and *portion size* ([3.7.3](#)).

3.8.1

least-square size

global linear size ([3.8](#)) for which an associated integral feature is established from the extracted integral feature(s) with the total least-square criterion

Note 1 to entry: In this document, “total least-square” is referred to only as “least-square”. It minimizes the sum of the squares of distances existing between the associated integral feature and the extracted integral feature.

Note 2 to entry: See [Figure 4 d\)](#).

3.8.2

maximum inscribed size

global linear size ([3.8](#)) for which an associated integral feature is established from the extracted integral feature(s) with the maximum inscribed criterion

Note 1 to entry: In the case of an internal feature of linear size, the maximum inscribed size was previously called “mating size for an internal feature”. It maximizes the size of the associated integral feature that is inscribed in the extracted integral feature.

Note 2 to entry: See [Figure 4 b\)](#).

3.8.3

minimum circumscribed size

global linear size ([3.8](#)) for which an associated integral feature is established from the extracted integral feature(s) with the minimum circumscribed criterion

Note 1 to entry: In the case of an external feature of linear size, the minimum circumscribed size was previously called “mating size for an external feature”. It minimizes the size of the associated feature that is circumscribed to the extracted integral feature.

Note 2 to entry: See [Figure 4 c\)](#).