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**Geometrical product specifications  
(GPS) — Dimensional tolerancing —**

**Part 3:  
Angular sizes**

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

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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 Technical Committee ISO/TC 213, *Dimensional and geometrical product specifications and verification*.

ISO 14405 consists of the following parts, under the general title *Geometrical product specification (GPS) — Dimensional tolerancing*:

- Part 1: *Linear sizes*
- Part 2: *Dimensions other than linear sizes*
- Part 3: *Angular sizes*

## Introduction

This part of ISO 14405 is a geometrical product specification (GPS) standard and is to be regarded as a general GPS standard (see ISO 14638). In the general GPS matrix, it influences chain links “Symbols and indications”, “Feature requirements” and “Feature properties” of the size chain of standards.

The ISO/GPS Masterplan given in ISO 14638 gives an overview of the ISO/GPS system of which this part of ISO 14405 is a part. The fundamental rules of ISO/GPS given in ISO 8015 apply to this part of ISO 14405 and the default decision rules given in ISO 14253-1 apply to specifications made in accordance with this part of ISO 14405, unless otherwise indicated.

For more detailed information on the relation of this part of ISO 14405 to other standards and to the GPS matrix model, see [Annex D](#).

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# Geometrical product specifications (GPS) — Dimensional tolerancing —

## Part 3: Angular sizes

### 1 Scope

This part of ISO 14405 establishes the default specification operator for angular size and defines a number of special specification operators for features of angular size: cone (truncated, i.e. frustum, or not), wedge (truncated or not), two opposite straight lines (intersection of a wedge/truncated wedge and a plane perpendicular to the intersection straight line of the two planes of the wedge/truncated wedge, intersection of a cone/frustum and a plane containing the axis of revolution of the cone/frustum). See [Figure 1](#) and [Figure 2](#).

This part of ISO 14405 also defines the specification modifiers and the drawing indications for these angular sizes.

This part of ISO 14405 covers the following angular sizes:

- local angular size:
  - angular size between two lines;
  - portion angular size;
- global angular size:
  - direct global angular size:
    - least squares angular size;
    - minimax angular size;
  - rank order angular size/indirect global angular size:
    - maximum angular size;
    - minimum angular size;
    - average angular size;
    - range of angular sizes;
    - mid-range angular size;
    - median angular size;
    - standard deviation of angular size.

This part of ISO 14405 defines the meaning of tolerances of angular sizes indicated as

- + and/or - limit deviations, e.g.  $0^\circ/-0,5^\circ$ , or
- indicated with upper limit of size (ULS) and/or lower limit of size (LLS), e.g.  $35^\circ$  max. or  $15^\circ$  min.,  $34^\circ/36^\circ$ ,

— with or without modifiers.

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

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

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

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

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

ISO 14405-1:2016, *Geometrical product specifications (GPS) — Dimensional tolerancing — Part 1: Linear sizes*

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

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## 3 Terms and definitions

ISO 14405-3:2016

For the purposes of this document, the terms and definitions given in ISO 8015, ISO 17450-1, ISO 17450-2, ISO 17450-3, ISO 14405-1, ISO 14405-2 and the following apply.

For association criteria, it is assumed that the terms “least squares” and “Gaussian” are equivalent, as well as “minimax” and “Chebyshev”. In this document, the terms “least squares” and “minimax” are retained. The least squares criterion is understood without material constraint throughout this part of ISO 14405.

### 3.1 angular size

angular dimension of a cone or between two coplanar opposite straight lines or between two opposite non parallel planes

Note 1 to entry: The angular size is defined from nominal features or from associated features which are angular features of size.

Note 2 to entry: See example of angular size on [Figure 1](#) and [Figure 2](#).

Note 3 to entry: Definition of “angular feature of size (feature of angular size)” is given in ISO 17450-1, the angle dimension cannot be 0° or 180°.

Note 4 to entry: Angular features of size are of two types.

- Revolute angular feature of size: a cone or a frustum. Two opposite straight lines are established from a longitudinal section of a cone/frustum with a plane containing the associated axis of revolution of the cone/frustum.
- Prismatic angular feature of size: a wedge (truncated or not). Two opposite straight lines are established from a cross section of a wedge/truncated wedge with a plane perpendicular to the intersection straight line of the two associated planes of the wedge/truncated wedge.



Note 5 to entry: [Figure 1](#) and [Figure 2](#) illustrate angular features of size type wedge, cone, frustum and two lines.

Note 6 to entry: [Figure 3a](#) and [Figure 3b](#) illustrate the case of an angular feature of size and an angular distance between two planes which is not an angular feature of size and shows that an angular feature of size exists when the material directions are opposed (when one of the features is rotated around their intersection line to coincide with the other feature, then the material is on the opposite sides for the two features). See also [Annex B](#).

Note 7 to entry: Envelope requirement cannot be applied for angular features of size.

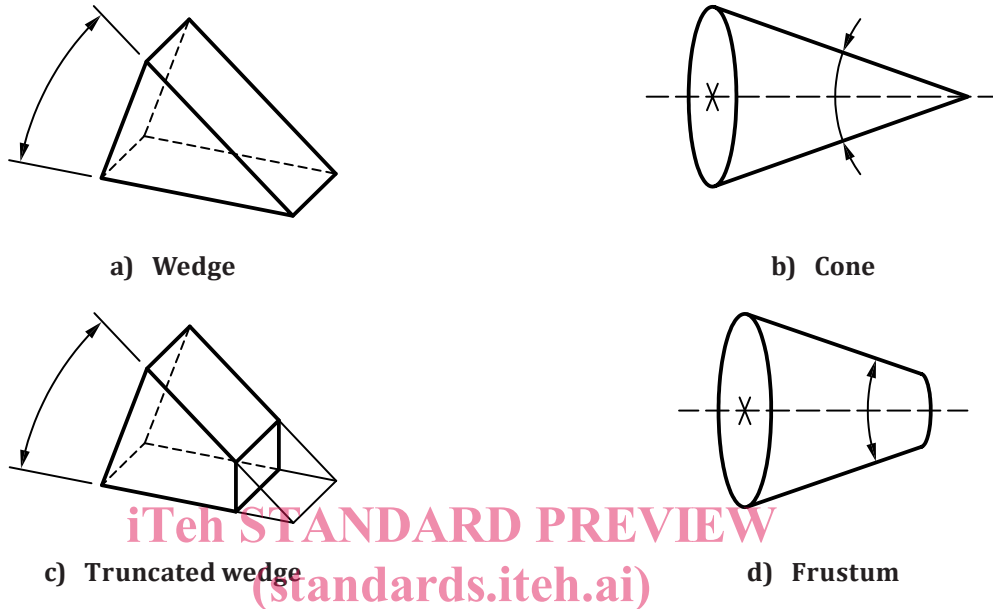


Figure 1 — Examples of areal angular features of size

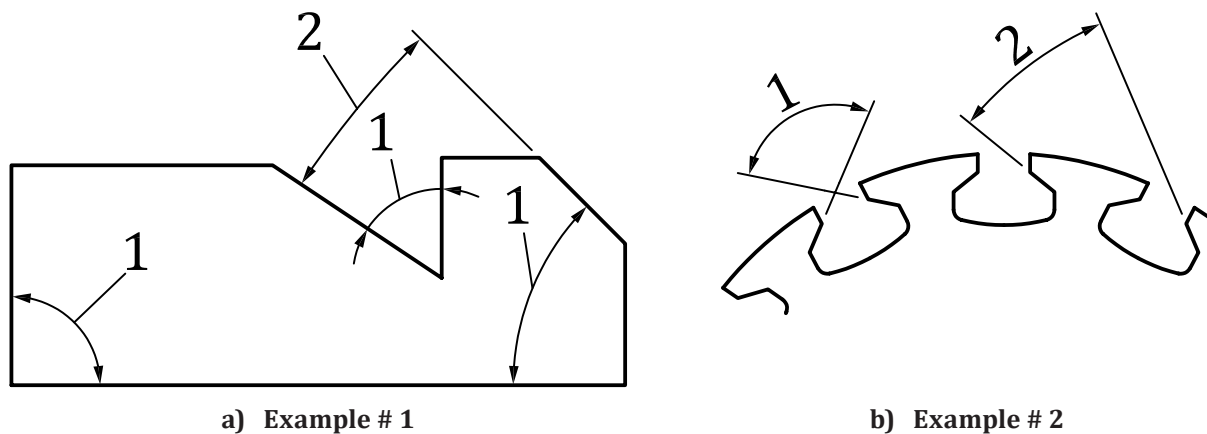
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a) Two opposite lines of a wedge

b) Two opposite generatrix lines of a cone

Figure 2 — Examples of angular features of size



**Key**

- 1 Feature of angular size
- 2 Non-feature of angular size

**Figure 3 — Examples of possible angular features of size**

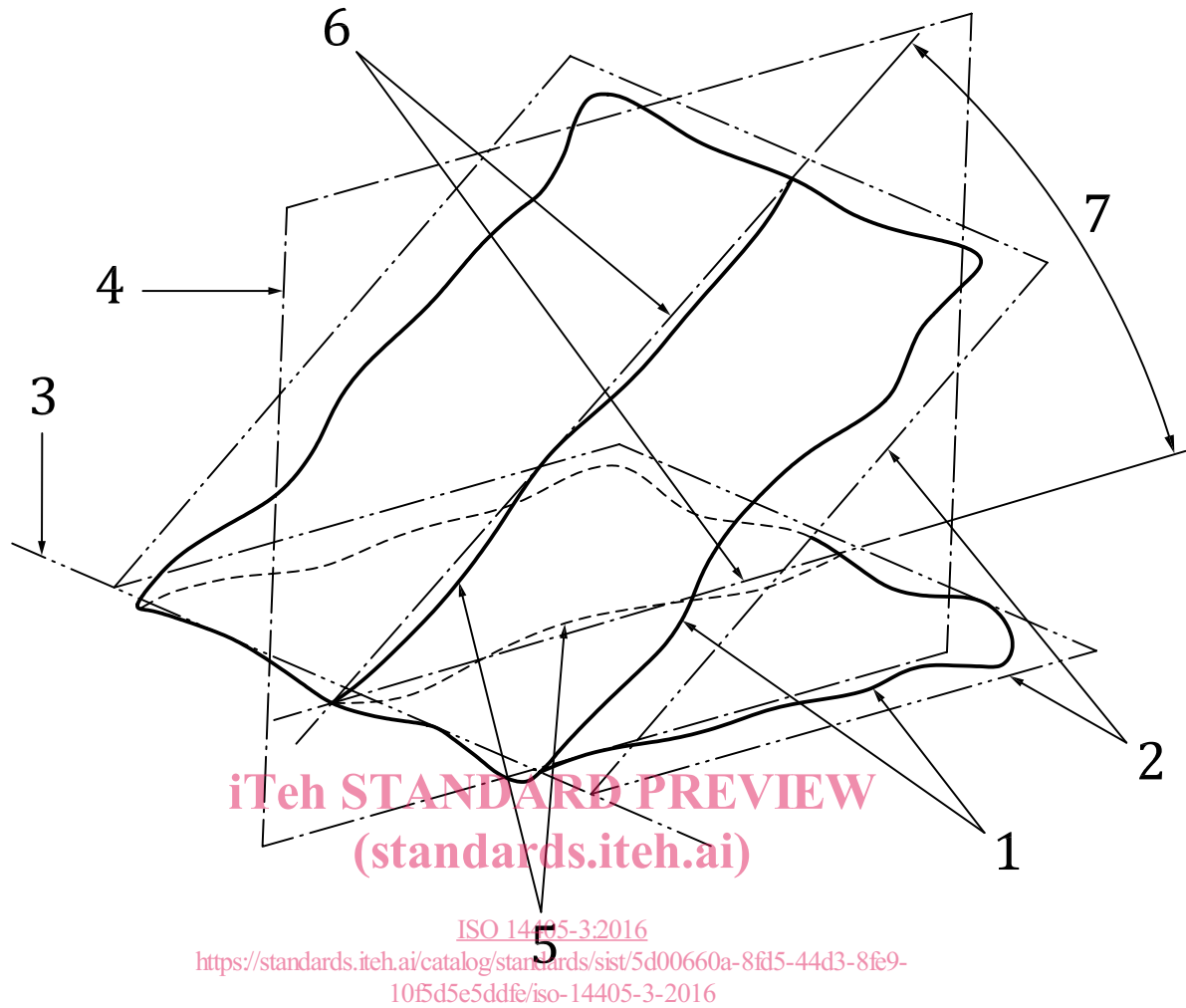
**3.2 local angular size**

**local angular size characteristic** angular size characteristic having a unique value for a specific location and a non-unique value along and/or around the angular feature of size (standards.iteh.ai)

Note 1 to entry: For a given feature, an infinite number of local angular sizes exists.

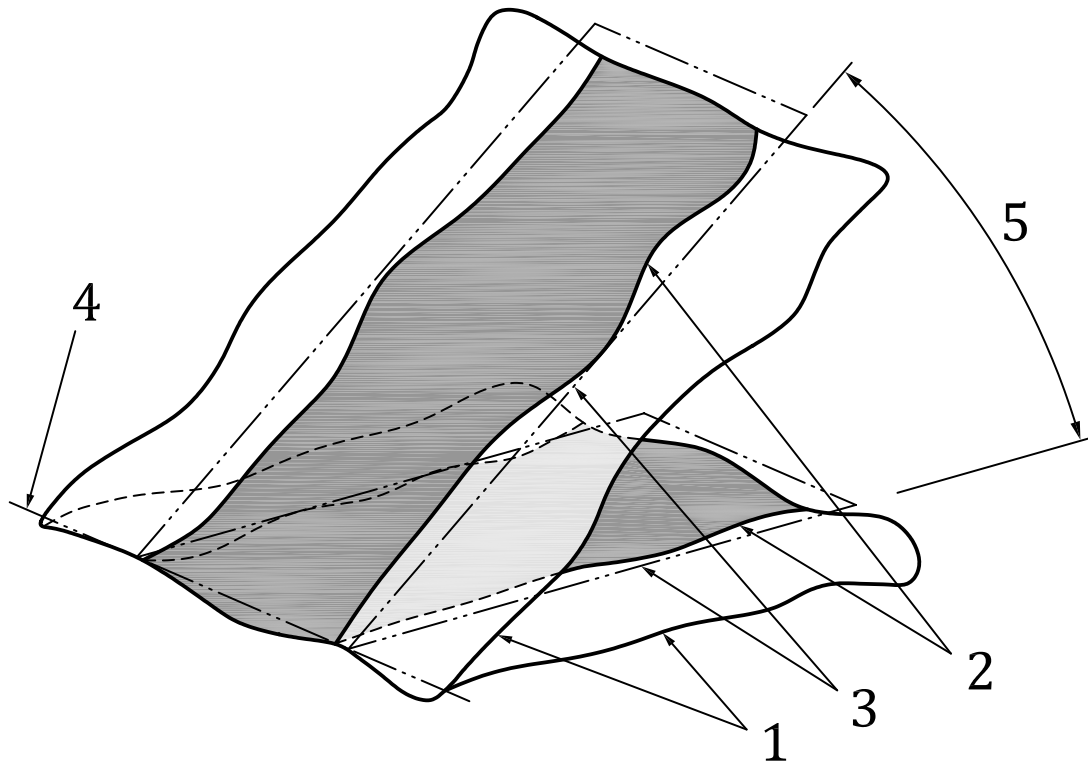
Note 2 to entry: In [Figure 4](#), an example of local angular size is shown.

Note 3 to entry: Two local angular size associations can be specified: least squares local angular size and minimax local angular size. See [Annex A](#).

**Key**

- 1 real angular feature of size
- 2 associated planes with (1)
- 3 intersection straight line of (2)
- 4 perpendicular cross section to (3)
- 5 two extracted lines
- 6 two associated straight lines
- 7 two-line angular size

**Figure 4 — Two-line angular size**



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**Key**

- 1 real angular feature of size
- 2 portion of (1)
- 3 associated planes with (2)
- 4 intersection straight line of (3)
- 5 portion angular size

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**Figure 5 — Portion angular size**

**3.2.1**

**two-line angular size**

**local angular size between two lines**

angle between two associated straight lines established from two extracted lines obtained from the intersection with an intersection plane defined from the associated angular feature of size

Note 1 to entry: See [Figure 4](#).

Note 2 to entry: The process for establishing the two-line angular size depends on the invariance class of the feature: revolute surface or prismatic surface.

Note 3 to entry: The default specification operator defining the two-line angular size is described in [Annex A](#).

**3.2.1.1**

**two-line revolute angular size**

*two-line angular size* ([3.2.1](#)) where the straight lines are associated with two extracted lines resulting from the intersection of an extracted revolute feature with a plane containing its associated axis

Note 1 to entry: The axis of the associated revolute feature is the “directly associated median line” described in ISO 22432:2011, 3.5.1.2.4.