

# SLOVENSKI STANDARD

## SIST EN ISO 286-1:2010

01-december-2010

Nadomešča:

SIST EN 20286-1:2000

SIST ISO 1829:1999

SIST ISO 286-1:1999

---

**Specifikacija geometrijskih veličin izdelka - Tolerančni sistem ISO za dolžinske mere - 1. del: Osnova za tolerance, odstopanja in ujeme (ISO 286-1:2010)**

Geometrical product specifications (GPS) - ISO code system for tolerances on linear sizes - Part 1: Basis of tolerances, deviations and fits (ISO 286-1:2010)

(standards.iteh.ai)

Geometrische Produktspezifikation (GPS) - ISO-Toleranzsystem für Längenmaße - Teil 1: Grundlagen für Toleranzen, Abmaße und Passungen (ISO 286-1:2010)

<https://standards.iteh.ai/catalog/standards/sist/4fb3ef05-7d8d-4628-899a-d4b862e1e54f/sist-en-iso-286-1-2010>

Spécification géométrique des produits (GPS) - Systeme de codification ISO pour les tolérances sur les tailles linéaires - Partie 1: Base des tolérances, écarts et ajustements (ISO 286-1:2010)

**Ta slovenski standard je istoveten z: EN ISO 286-1:2010**

---

**ICS:**

|           |                                                   |                                         |
|-----------|---------------------------------------------------|-----------------------------------------|
| 17.040.10 | Tolerance in ujemi                                | Limits and fits                         |
| 17.040.40 | Specifikacija geometrijskih veličin izdelka (GPS) | Geometrical Product Specification (GPS) |

**SIST EN ISO 286-1:2010**

**en,fr,de**

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

SIST EN ISO 286-1:2010

<https://standards.iteh.ai/catalog/standards/sist/4fb3ef05-7d8d-4628-899a-d4b862e1e54f/sist-en-iso-286-1-2010>

EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN ISO 286-1**

April 2010

ICS 17.040.10

Supersedes EN 20286-1:1993

English Version

**Geometrical product specifications (GPS) - ISO code system for  
tolerances on linear sizes - Part 1: Basis of tolerances,  
deviations and fits (ISO 286-1:2010)**

Spécification géométrique des produits (GPS) - Système  
de codification ISO pour les tolérances sur les tailles  
linéaires - Partie 1: Base des tolérances, écarts et  
ajustements (ISO 286-1:2010)

Geometrische Produktspezifikation (GPS) - ISO-  
Toleranzsystem für Längenmaße - Teil 1: Grundlagen für  
Toleranzen, Abmaße und Passungen (ISO 286-1:2010)

This European Standard was approved by CEN on 6 February 2010.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

CEN members are the national standards bodies of 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, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

**Management Centre: Avenue Marnix 17, B-1000 Brussels**

**Contents**

Page

Foreword.....3

**iTeh STANDARD PREVIEW  
(standards.iteh.ai)**

SIST EN ISO 286-1:2010

<https://standards.iteh.ai/catalog/standards/sist/4fb3ef05-7d8d-4628-899a-d4b862e1e54f/sist-en-iso-286-1-2010>

## Foreword

This document (EN ISO 286-1:2010) 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 October 2010, and conflicting national standards shall be withdrawn at the latest by October 2010.

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

This document supersedes EN 20286-1:1993.

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, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

**ITEH STANDARD PREVIEW**  
**(standards.iteh.ai)**  
**Endorsement notice**

The text of ISO 286-1:2010 has been approved by CEN as a EN ISO 286-1:2010 without any modification.

<https://standards.iteh.ai/catalog/standards/sist/4fb3ef05-7d8d-4628-899a-d4b862e1e54f/sist-en-iso-286-1-2010>

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

SIST EN ISO 286-1:2010

<https://standards.iteh.ai/catalog/standards/sist/4fb3ef05-7d8d-4628-899a-d4b862e1e54f/sist-en-iso-286-1-2010>

# INTERNATIONAL STANDARD

**ISO**  
**286-1**

Second edition  
2010-04-15

---

---

## Geometrical product specifications (GPS) — ISO code system for tolerances on linear sizes —

### Part 1: Basis of tolerances, deviations and fits

*Spécification géométrique des produits (GPS) — Système de  
codification ISO pour les tolérances sur les tailles linéaires —  
Partie 1. Base des tolérances, écarts et ajustements*

[SIST EN ISO 286-1:2010](https://standards.iteh.ai/catalog/standards/sist/4fb3ef05-7d8d-4628-899a-d4b862e1e54f/sist-en-iso-286-1-2010)

[https://standards.iteh.ai/catalog/standards/sist/4fb3ef05-7d8d-4628-899a-  
d4b862e1e54f/sist-en-iso-286-1-2010](https://standards.iteh.ai/catalog/standards/sist/4fb3ef05-7d8d-4628-899a-d4b862e1e54f/sist-en-iso-286-1-2010)



Reference number  
ISO 286-1:2010(E)

© ISO 2010

**PDF disclaimer**

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

## iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN ISO 286-1:2010](https://standards.iteh.ai/catalog/standards/sist/4fb3ef05-7d8d-4628-899a-d4b862e1e54f/sist-en-iso-286-1-2010)

<https://standards.iteh.ai/catalog/standards/sist/4fb3ef05-7d8d-4628-899a-d4b862e1e54f/sist-en-iso-286-1-2010>

**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2010

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
Case postale 56 • CH-1211 Geneva 20  
Tel. + 41 22 749 01 11  
Fax + 41 22 749 09 47  
E-mail [copyright@iso.org](mailto:copyright@iso.org)  
Web [www.iso.org](http://www.iso.org)

Published in Switzerland



## Contents

Page

|                                                                                                                    |           |
|--------------------------------------------------------------------------------------------------------------------|-----------|
| Foreword .....                                                                                                     | iv        |
| Introduction.....                                                                                                  | v         |
| <b>1 Scope .....</b>                                                                                               | <b>1</b>  |
| <b>2 Normative references .....</b>                                                                                | <b>1</b>  |
| <b>3 Terms and definitions .....</b>                                                                               | <b>1</b>  |
| <b>3.1 Basic terminology .....</b>                                                                                 | <b>2</b>  |
| <b>3.2 Terminology related to tolerances and deviations .....</b>                                                  | <b>2</b>  |
| <b>3.3 Terminology related to fits .....</b>                                                                       | <b>5</b>  |
| <b>3.4 Terminology related to the ISO fit system .....</b>                                                         | <b>9</b>  |
| <b>4 ISO code system for tolerances on linear sizes.....</b>                                                       | <b>11</b> |
| <b>4.1 Basic concepts and designations .....</b>                                                                   | <b>11</b> |
| <b>4.2 Designation of the tolerance class (writing rules).....</b>                                                 | <b>13</b> |
| <b>4.3 Determination of the limit deviations (reading rules).....</b>                                              | <b>14</b> |
| <b>4.4 Selection of tolerance classes .....</b>                                                                    | <b>26</b> |
| <b>5 ISO fit system.....</b>                                                                                       | <b>26</b> |
| <b>5.1 General .....</b>                                                                                           | <b>26</b> |
| <b>5.2 Generics of fits .....</b>                                                                                  | <b>27</b> |
| <b>5.3 Determination of a fit.....</b>                                                                             | <b>27</b> |
| <b>Annex A (informative) Further information about the ISO system of limits and fits and former practice .....</b> | <b>29</b> |
| <b>Annex B (informative) Examples of the use of ISO 286-1 to determine fits and tolerance classes .....</b>        | <b>31</b> |
| <b>Annex C (informative) Relationship to the GPS matrix model .....</b>                                            | <b>36</b> |
| <b>Bibliography.....</b>                                                                                           | <b>38</b> |

## ISO 286-1:2010(E)

## 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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 286-1 was prepared by Technical Committee ISO/TC 213, *Dimensional and geometrical product specifications and verification*.

This second edition of ISO 286-1 cancels and replaces ISO 286-1:1988 and ISO 1829:1975, which have been technically revised.

ISO 286 consists of the following parts, under the general title *Geometrical product specifications (GPS) — ISO code system for tolerances on linear sizes*: [SIST EN ISO 286-1:2010](https://standards.iteh.ai/catalog/standards/sist/4fb3ef05-7d8d-4628-899a-d4b862e1e54f/sist-en-iso-286-1-2010)

— *Part 1: Basis of tolerances, deviations and fits*

— *Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts*

## Introduction

This International Standard is a geometrical product specification (GPS) standard and is to be regarded as a general GPS standard (see ISO/TR 14638). It influences chain links 1 and 2 of the chain of standards on size in the general GPS matrix.

For more detailed information on the relation of this part of ISO 286 to the GPS matrix model, see Annex C.

The need for limits and fits for machined workpieces was brought about mainly by the requirement for interchange ability between mass produced parts and the inherent inaccuracy of manufacturing methods, coupled with the fact that “exactness” of size was found to be unnecessary for the most workpiece features. In order that fit function could be satisfied, it was found sufficient to manufacture a given workpiece so that its size lay within two permissible limits, i.e. a tolerance, this being the variation in size acceptable in manufacture while ensuring the functional fit requirements of the product.

Similarly, where a specific fit condition is required between mating features of two different workpieces, it is necessary to ascribe an allowance, either positive or negative, to the nominal size to achieve the required clearance or interference. This part of ISO 286 gives the internationally accepted code system for tolerances on linear sizes. It provides a system of tolerances and deviations suitable for two features of size types: “cylinder” and “two parallel opposite surfaces”. The main intention of this code system is the fulfilment of the function fit.

### iTeh STANDARD PREVIEW

The terms “hole”, “shaft” and “diameter” are used to designate features of size type cylinder (e.g. for the tolerancing of diameter of a hole or shaft). For simplicity, they are also used for two parallel opposite surfaces (e.g. for the tolerancing of thickness of a key or width of a slot).

The pre-condition for the application of the ISO code system for tolerances on linear sizes for the features forming a fit is that the nominal sizes of the hole and the shaft are identical.

The previous edition of ISO 286-1 (published in 1988) had the envelope criterion as the default association criterion for the size of a feature of size; however, ISO 14405-1 changes this default association criterion to the two-point size criterion. This means that form is no longer controlled by the default specification of size.

In many cases, the diameter tolerances according to this part of ISO 286 are not sufficient for an effective control of the intended function of the fit. The envelope criterion according to ISO 14405-1 may be required. In addition, the use of geometrical form tolerances and surface texture requirements may improve the control of the intended function.

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

SIST EN ISO 286-1:2010

<https://standards.iteh.ai/catalog/standards/sist/4fb3ef05-7d8d-4628-899a-d4b862e1e54f/sist-en-iso-286-1-2010>

# Geometrical product specifications (GPS) — ISO code system for tolerances on linear sizes —

## Part 1: Basis of tolerances, deviations and fits

### 1 Scope

This part of ISO 286 establishes the ISO code system for tolerances to be used for linear sizes of features of the following types:

- a) cylinder;
- b) two parallel opposite surfaces.

It defines the basic concepts and the related terminology for this code system. It provides a standardized selection of tolerance classes for general purposes from amongst the numerous possibilities.

Additionally, it defines the basic terminology for fits between two features of size without constraints of orientation and location and explains the principles of “basic hole” and “basic shaft”.

<https://standards.iteh.ai/catalog/standards/sist/4fb3ef05-7d8d-4628-899a-d4b862e1e54f/sist-en-iso-286-1-2010>

### 2 Normative references

The following referenced documents are indispensable for the application 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 286-2<sup>1)</sup>, *Geometrical product specifications (GPS) — ISO code system for tolerances on linear sizes — Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts*

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

ISO 14660-1:1999, *Geometrical Product Specifications (GPS) — Geometrical features — Part 1: General terms and definitions*

ISO 14660-2:1999, *Geometrical Product Specifications (GPS) — Geometrical features — Part 2: Extracted median line of a cylinder and a cone, extracted median surface, local size of an extracted feature*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14405-1 and ISO 14660-1 and the following apply. It should be noted, however, that some of the terms are defined in a more restricted sense than in common usage.

1) To be published. (Revision of ISO 286-2:1988)

**ISO 286-1:2010(E)****3.1 Basic terminology****3.1.1****feature of size**

geometrical shape defined by a linear or angular dimension which is a size

[ISO 14660-1:1999, definition 2.2]

NOTE 1 The feature of size can be a cylinder, a sphere, two parallel opposite surfaces.

NOTE 2 In former editions of international standards, such as ISO 286-1 and ISO/R 1938, the meanings of the terms “plain workpiece” and “single features” are close to that of “feature of size”.

NOTE 3 For the purpose of ISO 286, only features of size type cylinder as well as type-two parallel opposite surfaces, defined by a linear dimension, apply.

**3.1.2****nominal integral feature**

theoretically exact integral feature as defined by a technical drawing or by other means

[ISO 14660-1:1999, definition 2.3]

**3.1.3****hole**

internal feature of size of a workpiece, including internal features of size which are not cylindrical

NOTE See also Introduction.

**iTeh STANDARD PREVIEW**  
(standards.iteh.ai)

**3.1.4****basic hole**

hole chosen as a basis for a hole-basis fit system

[SIST EN ISO 286-1:2010](https://standards.iteh.ai/catalog/standards/sist/4fb3ef05-7d8d-4628-899a-d4b862e1e54f/sist-en-iso-286-1-2010)

NOTE 1 See also 3.4.1.1. <https://standards.iteh.ai/catalog/standards/sist/4fb3ef05-7d8d-4628-899a-d4b862e1e54f/sist-en-iso-286-1-2010>

NOTE 2 For the purpose of the ISO code system, a basic hole is a hole for which the lower limit deviation is zero.

**3.1.5****shaft**

external feature of size of a workpiece, including external features of size which are not cylindrical

NOTE See also Introduction.

**3.1.6****basic shaft**

shaft chosen as a basis for a shaft-basis fit system

NOTE 1 See also 3.4.1.2.

NOTE 2 For the purposes of the ISO code system, a basic shaft is a shaft for which the upper limit deviation is zero.

**3.2 Terminology related to tolerances and deviations****3.2.1****nominal size**

size of a feature of perfect form as defined by the drawing specification

See Figure 1.

NOTE 1 Nominal size is used for the location of the limits of size by the application of the upper and lower limit deviations.

NOTE 2 In former times, this was referred to as “basic size”.

**3.2.2****actual size**

size of the associated integral feature

NOTE 1 “Associated integral feature” is defined in ISO 14660-1:1999, 2.6.

NOTE 2 The actual size is obtained by measurement.

**3.2.3****limits of size**

extreme permissible sizes of a feature of size

NOTE To fulfil the requirement, the actual size shall lie between the upper and lower limits of size; the limits of size are also included.

**3.2.3.1****upper limit of size****ULS**

largest permissible size of a feature of size

See Figure 1.

**3.2.3.2****lower limit of size****LLS**

smallest permissible size of a feature of size

See Figure 1.

**3.2.4****deviation**

value minus its reference value

[SIST EN ISO 286-1:2010](https://standards.iteh.ai/catalog/standards/sist/4fb3ef05-7d8d-4628-899a-d4b862e1e54f/sist-en-iso-286-1-2010)

NOTE For size deviations, the reference value is the nominal size and the value is the actual size.

**3.2.5****limit deviation**

upper limit deviation or lower limit deviation from nominal size

**3.2.5.1****upper limit deviation**

*ES* (to be used for internal features of size)

*es* (to be used for external features of size)

upper limit of size minus nominal size

See Figure 1.

NOTE Upper limit deviation is a signed value and may be negative, zero or positive.