ISO 1101:2012

INTERNATIONAL STANDARD

Geometrical product specifications

(GPS) — Geometrical tolerancing —

Tolerances of form, orientation, location

and run-out

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 1101 was prepared by Technical Committee ISO/TC 213, *Dimensional and geometrical product specifications and verification*.
This third edition cancels and replaces the second edition (ISO 1101:2004) and ISO 10578:1992. Representations of specifications in the form of a 3D model have been added.

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, 2 and 3 of the chain of standards on form, orientation, location and run out, and chain link 1 of the chain of standards on datums.
The ISO GPS Masterplan given in ISO/TR 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. The default decision rules given in ISO 14253-1 apply to specifications made in accordance with this document, unless otherwise stated.

For more detailed information on the relation of this International Standard to the GPS matrix model, see Annex D.

This International Standard represents the initial basis and describes the required fundamentals for geometrical tolerancing. Nevertheless, it is advisable to consult the separate standards referenced in Clause 2 and in Table 2 for more detailed information.

For the presentation of lettering (proportions and dimensions), see ISO 3098-2.

All figures in this International Standard for the 2D drawing indications have been drawn in first-angle projection with dimensions and tolerances in millimetres. It should be understood that third-angle projection and other units of measurement could have been used equally well without prejudice to the principles established. For all figures giving tolerancing examples in 3D, the dimensions and tolerances are the same as for the similar figures shown in 2D.

The figures in this International Standard illustrate the text and are not intended to reflect an actual application. Consequently, the figures are not fully dimensioned and toleranced, showing only the relevant general principles. Neither are the figures intended to imply a particular display requirement in terms of whether hidden detail, tangent lines or other annotations are shown or not shown. Many figures have lines or details removed for clarity, or added or extended to assist with the illustration of the text.

For a definitive presentation (proportions and dimensions) of the symbolization for geometrical tolerancing, see ISO 7083.

Annex A of this International Standard has been provided for information only. It presents previous drawing indications that have been omitted here and are no longer used.

It needs to be noted that the former use of the term “circularity” has been changed to the term “roundness” for reasons of consistency with other standards.

Definitions of features are taken from ISO 14660-1 and ISO 14660-2, which provide new terms different from those used in previous edition of this International Standard. The former terms are indicated in the text following the new terms, between parentheses.

For the purposes of this International Standard, the terms “axis” and “median plane” are used for derived features of perfect form, and the terms “median line” and “median surface” for derived features of imperfect form. Furthermore, the following line types have been used in the explanatory illustrations, i.e. those representing non-technical drawings for which the rules of ISO 128 (all parts) apply.

vel	Feature type	Details	Line type	
			Visible	B
	integral feature	point line/axis surface/plane	wide continuous	
	derived feature	point line/axis face/plane	narrow long dashed dotted	na
	integral feature	surface	wide freehand continuous	nar
	integral surface	point line surface	wide short dashed	n
	derived feature	point line face	wide dotted	
	integral feature	point straight line	wide doubled-dashed double-dotted	narrow d

⁄el	Feature type	Details	Line type	
			Visible	B
		ideal feature		
		point		
	derived feature	straight line	narrow long dashed double-dotted	
		plane		
	datum	point line surface/plane	wide long dashed double-short dashed	narrow long
s planes		line surface	continuous narrow	
ıg plane, aid plane		line surface	narrow long dashed short dashed	
d reference lines		line	continuous narrow	

IMPORTANT — **The illustrations included in this International Standard 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.

1 Scope

This International Standard contains basic information and gives requirements for the geometrical tolerancing of workpieces.
It represents the initial basis and defines the fundamentals for geometrical tolerancing.

NOTE Other International Standards referenced in Clause 2 and in Table 2 provide more detailed information on geometrical tolerancing.

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 128-24:1999, *Technical drawings — General principles of presentation — Part 24: Lines on mechanical engineering drawings*
- ISO 1660:1987, *Technical drawings — Dimensioning and tolerancing of profiles*
- ISO 2692:2006, *Geometrical product specifications (GPS) — Geometrical tolerancing — Maximum material requirement (MMR), least material requirement (LMR) and reciprocity requirement (RPR)*
- ISO 5458:1998, *Geometrical Product Specifications (GPS) — Geometrical tolerancing — Positional tolerancing*
- ISO 5459:2011, *Geometrical product specifications (GPS) — Geometrical tolerancing — Datums and datum systems*

- ISO 8015:2011, *Geometrical product specifications (GPS) — Fundamentals — Concepts, principles and rules*
- ISO 10579:2010, *Geometrical product specifications (GPS) — Dimensioning and tolerancing — Non-rigid parts*
- ISO 12180-1:2011, *Geometrical product specifications (GPS) — Cylindricity — Part 1: Vocabulary and parameters of cylindrical form*
- ISO 12180-2:2011, *Geometrical product specifications (GPS) — Cylindricity — Part 2: Specification operators*
- ISO 12181-1:2011, *Geometrical product specifications (GPS) — Roundness — Part 1: Vocabulary and parameters of roundness*
- ISO 12181-2:2011, *Geometrical product specifications (GPS) — Roundness — Part 2: Specification operators*
- ISO 12780-1:2011, *Geometrical product specifications (GPS) — Straightness — Part 1: Vocabulary and parameters of straightness*
- ISO 12780-2:2011, *Geometrical product specifications (GPS) — Straightness — Part 2: Specification operators*
- ISO 12781-1:2011, *Geometrical product specifications (GPS) — Flatness — Part 1: Vocabulary and parameters of flatness*
- ISO 12781-2:2011, *Geometrical product specifications (GPS) — Flatness — Part 2: Specification operators*
- 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*
- ISO 17450-2:—[1], *Geometrical product specifications (GPS) — General concepts — Part 2: Basic tenets, specifications, operators and uncertainties*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14660-1 and ISO 14660-2 and the following apply.

3.1
tolerance zone
space limited by one or several geometrically perfect lines or surfaces, and characterized by a linear dimension, called a tolerance
SEE:

3.2
intersection plane
plane, established from an extracted feature of the workpiece, identifying a line on an extracted surface (integral or median) or a point on an extracted line
Note 1 to entry: The use of intersection planes makes it possible to define toleranced features independent of the view.

3.3
orientation plane

plane, established from an extracted feature of the workpiece, identifying the orientation of the tolerance zone

Note 1 to entry: For a derived feature, the use of an orientation plane makes it possible to define the direction of the width of the tolerance zone independent of the TEDs (case of location) or of the datum (case of orientation).

Note 2 to entry: The orientation plane is only used when the toleranced feature is a median feature (centre point, median straight line) and the tolerance zone is defined by two parallel straight lines or two parallel planes.

3.4

direction feature

feature, established from an extracted feature of the workpiece, identifying the direction of the width of the tolerance zone

Note 1 to entry: The direction feature can be a plane, a cylinder or a cone.

Note 2 to entry: For a line in a surface, the use of a direction feature makes it possible to change the direction of the width of the tolerance zone.

Note 3 to entry: The direction feature is used on a complex surface or a complex profile when the direction of the tolerance value is not normal to the specified geometry.

Note 4 to entry: By default, the direction feature is a cone, a cylinder or a plane constructed from the datum or datum system indicated in the second compartment of the direction feature indicator. The geometry of the direction feature depends on the geometry of the toleranced feature.

3.5

compound contiguous feature

feature composed of several single features joined together without gaps

Note 1 to entry: A compound contiguous feature can be closed or not.

Note 2 to entry: A non-closed compound contiguous feature can be defined by the way of using the “between” symbol (see 10.1.4).

Note 3 to entry: A closed compound contiguous feature can be defined by the way of using the “all around” symbol (see 10.1.2). In this case, it is a set of single features whose intersection with any plane parallel to a collection plane is a line or a point.

3.6

collection plane

plane, established from a nominal feature on the workpiece, defining a closed compound contiguous feature

Note 1 to entry: The collection plane may be required when the “all around” symbol is applied.

3.7

theoretically exact dimension

TED

dimension indicated on technical product documentation, which is not affected by an individual or general tolerance

Note 1 to entry: For the purpose of this International Standard, the term “theoretically exact dimension” has been abbreviated TED.

Note 2 to entry: A theoretically exact dimension is a dimension used in operations (e.g. association, partition, collection, …).

Note 3 to entry: A theoretically exact dimension can be a linear dimension or an angular dimension.

Note 4 to entry: A TED can define

- — the extension or the relative location of a portion of one feature,
- — the length of the projection of a feature,
- — the theoretical orientation or location from one or more features, or
- — the nominal shape of a feature.

Note 5 to entry: A TED is indicated by a rectangular frame including a value.

Bibliography

[1] ISO 128 (all parts), *Technical drawings — General principles of presentation*

[2] ISO 129 (all parts), *Technical drawings — Indication of dimensions and tolerances*

[3] ISO 3040:1990, *Technical drawings — Dimensioning and tolerancing — Cones*

[4] ISO 3098-0, *Technical product documentation — Lettering — Part 0: General requirements*

[5] ISO 3098-2:2000, *Technical product documentation — Lettering — Part 2: Latin alphabet, numerals and marks*

[6] ISO/TR 5460:1985, *Technical drawings — Geometrical tolerancing — Tolerancing of form, orientation, location and run-out — Verification principles and methods — Guidelines*

[7] ISO 7083:1983, *Technical drawings — Symbols for geometrical tolerancing — Proportions and dimensions*

[8] ISO/TR 14638:1995, *Geometrical product specification (GPS) — Masterplan*

[9] ISO 16792, *Technical product documentation — Digital product definition data practices*

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

[11] ISO 3098-5, *Technical product documentation — Lettering — Part 5: CAD Lettering of the Latin alphabet, numerals and marks*

[1] To be published. (Revision of ISO/TS 17450-2:2002)