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Geometrical product specifications (GPS) — Geometrical tolerancing — Profile tolerancing

Spécification géométrique des produits (GPS) — Tolérancement géométrique — Tolérancement des profils

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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 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.

This document 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 1660:1987), which has been technically revised with the following changes:

— the requirements for defining the theoretically exact feature (the nominal geometry) have been made more explicit;

— the definition of what constitutes the toleranced feature has been clarified and updated to follow the feature principle, (see ISO 8015:2011, 5.5);

— tools for defining specifications for restricted features and compound features have been added;

— tools for defining specifications using unequally disposed or offset tolerance zones have been added;

— tools for defining specifications using tolerance zone of variable width have been added.

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 the chain links A, B and C of the chains of standards on form, orientation and location.

The ISO GPS Masterplan 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 specifications made in accordance with this document, unless otherwise indicated.

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

This document provides rules for profile tolerancing.

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

All figures in this document 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 specification examples in 3D, the dimensions and tolerances are the same as for the similar figures shown in 2D.

The figures in this document represent either 2D drawing views or 3D axonometric views on 2D drawings and are intended to illustrate how a specification can be fully indicated with visible annotation. For possibilities of illustrating a specification, where elements of the specification may be available through a query function or other interrogation of information in the 3D CAD model and rules for attaching specifications to 3D CAD models, see ISO 16792.

The figures in this document illustrate the text and are not intended to reflect an actual application. Consequently, the figures are not fully dimensioned and specified, 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. See Table 1 for the line types used in definition figures.

In order for a GPS specification to be unambiguous, the partition defining the boundary of the toleranced feature, as well as the filtering should be well defined. Currently, the detailed rules for partitioning and the default for filtering are not defined in GPS standards.

For a definitive presentation (proportions and dimensions) of symbols for geometrical tolerancing, see ISO 7083 and ISO 1101:2017, Annex F.

For the purposes of this document, 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.

Table 1

Feature level	Feature type	Details	Line type	
			Visible	**Behind plane/ surface**
Nominal feature	integral feature	point line/axis surface/plane	wide continuous	narrow dashed
	derived feature	point line/axis surface/plane	narrow long dashed dotted	narrow dashed dotted
Real feature	integral feature	surface	wide freehand continuous	narrow freehand dashed
Extracted feature	integral feature	point line surface	wide short dashed	narrow short dashed
	derived feature	point line surface	wide dotted	narrow dotted
Filtered feature	integral feature	line surface	continuous narrow	continuous narrow
Associated feature	integral feature	point straight line plane	wide doubled-dashed double-dotted	narrow double-dashed double-dotted
	derived feature	point straight line (axis) plane	narrow long dashed double-dotted	wide dashed double-dotted
	datum	point line/axis surface/plane	wide long dashed double-short dashed	narrow long dashed double-short dashed
Tolerance zone limits, tolerance planes		line surface	continuous narrow	narrow dashed
Section, illustration plane, drawing plane, aid plane		line surface	narrow long dashed short dashed	narrow dashed short dashed
Extension, dimension, leader and reference lines		line	continuous narrow	narrow dashed

Contrary to other kinds of geometrical tolerancing, profile tolerancing also allows geometrical tolerancing of non-straight lines and non-flat surfaces, in addition to simpler features, such as planes, cylinders, etc. This makes profile tolerancing more complex than other geometrical tolerancing with respect to the definition of the nominal geometry and the extent of the toleranced feature. This document expands on and provides tools and rules for these two complexities.

This edition of ISO 1660 is a pilot project for writing rule-based standards for geometrical tolerancing rather than example-based standards. In the long term, it is envisioned that the content of this document will be integrated into a future rule-based ISO 1101.

This document references other standards for rules for GPS tolerancing in general and geometrical tolerancing in particular, rather than repeating those rules. These GPS principles and rules include, but are not limited to:

— the feature principle (see ISO 8015:2011, 5.4);

— the independency principle (see ISO 8015:2011, 5.5);

— the rules for implicit TEDs (see ISO 5458:1998, 4.3);

— the width of the tolerance zone applies normal to the toleranced feature (See ISO 1101:2017, Clause 7);

— the rules for identifying the toleranced features (see ISO 1101:2017, Clause 6 and 9.1);

— form specifications, i.e. specifications without reference to a datum, a datum system or a pattern, constrain neither orientation nor location (see ISO 1101:2017, 4.8);

— the tolerance zone can be constrained by reference to datums (see ISO 5459).