
**Geometrical Product Specifications
(GPS) — Cylindricity —**

**Part 1:
Vocabulary and parameters of cylindrical
form**

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*Spécification géométrique des produits (GPS) — Cylindricité —
Partie 1. Vocabulaire et paramètres de cylindricité*

ISO/TS 12180-1:2003

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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.

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.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

- an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;
- an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

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An ISO/PAS or ISO/TS is reviewed after three years in order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn. If the ISO/PAS or ISO/TS is confirmed, it is reviewed again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.

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/TS 12180-1 was prepared by Technical Committee ISO/TC 213, *Dimensional and geometrical product specifications and verification*.

ISO/TS 12180 consists of the following parts, under the general title *Geometrical Product Specifications (GPS) — Cylindricity*:

- *Part 1: Vocabulary and parameters of cylindrical form*
- *Part 2: Specification operators*

Introduction

This part of ISO/TS 12180 is a geometrical product specification (GPS) Technical Specification and is to be regarded as a general GPS document (see ISO/TR 14638). It influences chain link 2 of the chain of standards on form of a surface (independent of a datum).

For more detailed information on the relation of this part of ISO/TS 12180 to other standards and the GPS matrix model, see Annex D.

This part of ISO/TS 12180 defines terms and concepts necessary for defining the specification operators according to ISO/TS 17450-2 for cylindricity of integral features.

Extracting data will always involve applying a certain filtering process. An additional filtering of the extracted data may or may not be applied. This additional filter can be a mean line filter (Gaussian, spline, wavelet, etc.) or a non-linear filter (e.g. morphological filter). The type of filtering will influence the definition of cylindricity and the specification operators and, therefore, needs to be stated unambiguously.

This part of ISO/TS 12180 is not intended to disallow any means of measuring cylindricity.

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Geometrical Product Specifications (GPS) — Cylindricity —

Part 1: Vocabulary and parameters of cylindrical form

1 Scope

This part of ISO/TS 12180 defines the terms and concepts related to cylindricity of individual complete integral features only.

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/TS 12180-2:2003, *Geometrical Product Specifications (GPS) — Cylindricity — 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/TS 17450-1:—¹⁾, *Geometrical Product Specifications (GPS) — General concepts — Part 1: Model for geometrical specification and verification*

3 Terms and definitions

For the purposes of this part of ISO/TS 12180, the terms and definitions given in ISO 14660-1, ISO 14660-2, ISO/TS 17450-1 and the following apply.

3.1 General terms

3.1.1

cylindricity

property of a cylinder

1) To be published.

3.1.2

nominal cylinder

mathematically cylindrical form as specified by design intent

NOTE For the purposes of this part of ISO/TS 12180, the term “form of a nominal cylinder” is understood to mean the form of a right circular cylinder (i.e. it has a right angle between the cylinder axis and every circular cross-section).

3.1.3

reference circle

associated circle fitting the roundness profile in accordance with specified conventions, to which the deviations from roundness and the roundness parameters are referred

[ISO/TS 12181-1:2003, definition 3.3.1]

3.1.4

roundness plane

plane perpendicular to the roundness axis within the full extent of the feature

[ISO/TS 12181-1:2003, definition 3.1.3]

3.1.5

generatrix plane

half plane through the axis of the associated cylinder

3.2 Terms relating to the surface

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3.2.1

real surface of a workpiece

integral feature part of a real surface of a workpiece limited by the adjacent real (integral) features

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[ISO 14660-1:1999, definition 2.4]

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3.2.2

extracted surface

<cylindricity> digital representation of the real surface

NOTE The extraction conventions for cylindricity are given in ISO/TS 12180-2. This extracted surface is an extracted integral feature as defined in ISO 14660-1.

3.2.3

cylindricity surface

extracted surface (type cylinder) intentionally modified by a filter

NOTE This is the surface to which the concepts and parameters of this part of ISO/TS 12180 can be applied.

3.2.4

local cylindricity deviation

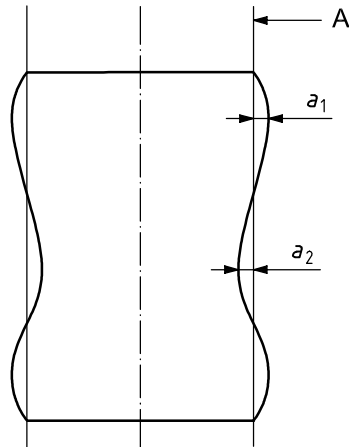
LCD

deviation of a point on a cylindricity surface from the reference cylinder, the deviation being normal to the reference cylinder

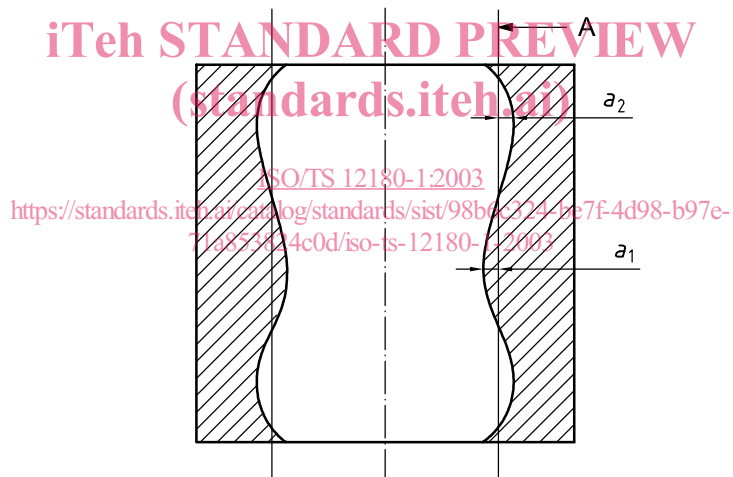
See Figures 1 and 2.

NOTE 1 The deviation is negative if from the reference cylinder the point lies in the direction of the material.

NOTE 2 For the reference cylinder, see 3.3.1.

**Key**

- A reference cylinder
- a_1 positive local deviation
- a_2 negative local deviation

Figure 1 — Local form deviation of an external cylindrical feature**Key**

- A reference cylinder
- a_1 positive local deviation
- a_2 negative local deviation

Figure 2 — Local form deviation of an internal cylindrical feature**3.2.5****roundness profile**

extracted circumferential line intentionally modified by a filter

[ISO/TS 12181-1:2003, definition 3.2.3]

3.2.6**extracted generatrix line**

digital representation of the line of intersection of the real surface and a generatrix plane

NOTE The extraction conventions for cylindricity are given in ISO/TS 12180-2. This extracted surface is an extracted integral feature as defined in ISO 14660-1.

**3.2.7
generatrix profile**

extracted generatrix line intentionally modified by a filter

**3.2.8
extracted median line of a cylinder**

locus of centres of cross-sections, where

- the centres of cross-sections are centres of associated circles, and
- the cross-sections are perpendicular to the axis of the associated cylinder obtained from the extracted surface (i.e. the radius could be different from the nominal radius)

[ISO 14660-2:1999, definition 3.2]

See Figure 3.



Key

A extracted median line

Figure 3 — Extracted median line of a cylinder

3.3 Terms relating to the reference cylinder

**3.3.1
reference cylinder**

associated cylinder fitting the cylindricity surface in accordance with specified conventions, to which the deviations from cylindrical form and the cylindricity parameters are referred

**3.3.1.1
minimum zone reference cylinders**

MZCY

two coaxial cylinders enclosing the cylindricity surface and having the least radial separation

**3.3.1.1.1
outer minimum zone reference cylinder**

outer cylinder of the minimum zone reference cylinders

3.3.1.1.2**inner minimum zone reference cylinder**

inner cylinder of the minimum zone reference cylinders

3.3.1.1.3**mean minimum zone reference cylinder**

arithmetic mean cylinder of the minimum zone reference cylinders

3.3.1.2**least squares reference cylinder****LSCY**

cylinder such that the sum of the squares of the local cylindricity deviations is a minimum

3.3.1.3**minimum circumscribed reference cylinder****MCCY**

smallest possible cylinder that can be fitted around the cylindricity surface

3.3.1.4**maximum inscribed reference cylinder****MICY**

largest possible cylinder that can be fitted within the cylindricity surface

NOTE Cases exist where MICY is not unique.

3.3.2**associated derived axis of a cylindrical feature**

axis of the reference cylinder(s)

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3.4 Terms relating to the circumference and the generatrix**3.4.1****undulations per revolution****UPR**

number of sinusoidal undulations contained in the roundness profile

[ISO/TS 12181-1:2003, definition 3.4.1]

3.4.2**circumferential wavelength**

circumference of the reference circle divided by the UPR

[ISO/TS 12181-1:2003, definition 3.4.2]

3.4.3**generatrix wavelength**

length of a generatrix divided by the number of sinusoidal undulations along that generatrix

NOTE The number of sinusoidal undulations is not necessarily an integer.

3.5 Terms relating to the filter function**3.5.1 General**

If not otherwise specified, the details of the filter characteristics are as specified in ISO/TS 12180-2.

NOTE Only the phase correct mean line filter is currently defined (see ISO 11562:1996, definition 2.2). Consequently, the terms in this clause relate only to this type of filter. Other filter methods are currently being investigated by ISO. It is anticipated that in a future version of this part of ISO/TS 12180, these new filters will be incorporated.