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**Rolling bearings — Cylindrical  
rollers —**

**Part 2:  
Boundary dimensions, geometrical  
product specifications (GPS) and  
tolerance values for ceramic rollers**

*Roulements — Rouleaux cylindriques —*

*Partie 2: Dimensions d'encombrement, spécification géométrique des  
produits (GPS) et valeurs de tolérance pour rouleaux en céramique*

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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 voluntary nature of standards, 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).

This document was prepared by Technical Committee ISO/TC 4, *Rolling bearings*, Subcommittee SC 5, *Needle, cylindrical and spherical roller bearings*.

A list of all parts in the ISO 12297 series can be found on the ISO website.

## Introduction

This document is a machine element geometry standard as defined in the geometrical product specification system (GPS system) described in the framework document ISO 14638.

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.

The connections between functional requirements, measuring technique and measuring uncertainty are considered. For measurement uncertainty, ISO 14253-2 is considered.

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# Rolling bearings — Cylindrical rollers —

## Part 2:

# Boundary dimensions, geometrical product specifications (GPS) and tolerance values for ceramic rollers

## 1 Scope

This document specifies dimensional and geometrical characteristics, nominal boundary dimensions and tolerance values for finished silicon nitride cylindrical rollers for rolling bearings.

[Annexes A](#) and [B](#) give the sorting principles for roller diameter and roller length tolerances and gauges, respectively.

[Annex C](#) gives examples of imperfection types and methods of inspection.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 4288, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Rules and procedures for the assessment of surface texture*

ISO 26602, *Fine ceramics (advanced ceramics, advanced technical ceramics) — Silicon nitride materials for rolling bearing balls and rollers*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

### 3.1

#### roller grade

#### G

specific combination of dimensional, form, roughness profile parameter and sorting tolerances for rollers

[SOURCE: ISO 5593:1997, 05.05.10]

## 4 Symbols

To demonstrate that the ISO GPS system, ISO 8015, has been applied, the dimensional and geometrical characteristics shall be included in the technical product documentation (for example, on the drawing). The dimensional and geometrical specifications associated with these characteristics are described in [Table 1](#) and [Figure 1](#).

A tolerance value associated with a characteristic is symbolized by  $t$  followed by the symbol for the characteristic, for example  $t_{VDwmp}$ .

In this document, the ISO default specification operator for size is in accordance with ISO 14405-1, i.e. the two-point size is valid.

**Table 1 — Symbols for dimensions, characteristics and specification modifiers**

Symbol for dimensions (size or distance)	Symbol for characteristic	GPS symbol and specification modifier	Description
$D_w$			Nominal roller diameter
	$D_{wmpx}$	Ⓐ Ⓢ ACS Ⓧ	Maximum of mid-range sizes of roller diameter in any cross-section (only to calculate $VD_{wL}$ )
	$VD_{wL}$		Difference between $D_{wmpx}$ of the largest and the smallest roller in a lot
	$VD_{wmp}$	Ⓐ Ⓢ ACS Ⓡ	Range of mid-range sizes (out of two-point sizes) of roller diameter obtained from any cross-sections of cylindrical part of the roller
	$VD_{wsr}$	Ⓐ ALS [B,C] Ⓡ ⓐ	Range of two-point sizes of roller diameter obtained from two cross-sections B and C in a certain and same distance from both ends of the roller in any longitudinal section
$L_w$			Nominal roller length
$R_{amax}$			Roughness profile parameter
	$r_s \text{ max.}$		Largest permissible radial or axial single chamfer dimensions of a roller
	$r_s \text{ min.}$		Smallest permissible radial or axial single chamfer dimensions of a roller
	$R_w$	ⓐ	Roundness of roller
	$SD_w$	↗	Axial circular run-out of a roller end face with respect to datum, i.e. axis, established from the roller's outside surface



**Table 2 — Dimensions for cylindrical rollers**

Dimensions in millimetres

$D_w$	$L_w$	$r_s$ min.	$r_s$ max.
3	3	0,1	0,7
3	4	0,1	0,7
3	5	0,1	0,7
3,5	5	0,1	0,7
4	4	0,2	0,7
4	6	0,2	0,7
4	8	0,2	0,7
4,5	4,5	0,2	0,7
4,5	6	0,2	0,7
5	5	0,2	0,7
5	8	0,2	0,7
5	10	0,2	0,7
5,5	5,5	0,2	0,7
5,5	8	0,2	0,7
6	6	0,2	0,7
6	8	0,2	0,7
6	9	0,2	0,7
6	10	0,2	0,7
6	12	0,2	0,7
6,5	6,5	0,2	0,8
6,5	8	0,2	0,8
6,5	9	0,2	0,8
7	7	0,2	0,8
7	10	0,2	0,8
7	14	0,2	0,8
7,5	7,5	0,2	0,8
7,5	9	0,2	0,8
7,5	10	0,2	0,8
7,5	11	0,2	0,8
8	8	0,3	0,8
8	10	0,3	0,8
8	12	0,3	0,8
8	14	0,3	0,8
8	16	0,3	0,8
8	20	0,3	0,8
9	9	0,3	1,0

Table 2 (continued)

$D_w$	$L_w$	$r_s$ min.	$r_s$ max.
9	10	0,3	1,0
9	12	0,3	1,0
9	13	0,3	1,0
9	14	0,3	1,0
10	10	0,3	1,0
10	11	0,3	1,0
10	14	0,3	1,0
10	15	0,3	1,0
10	16	0,3	1,0
10	17	0,3	1,0
10	25	0,3	1,0
11	11	0,3	1,0
11	12	0,3	1,0
11	13	0,3	1,0
11	15	0,3	1,0
11	20	0,3	1,0
12	12	0,3	1,0
12	14	0,3	1,0
12	16	0,3	1,0
12	17	0,3	1,0
12	18	0,3	1,0
12	21	0,3	1,0
12	22	0,3	1,0
13	13	0,3	1,2
13	18	0,3	1,2
13	20	0,3	1,2
14	14	0,3	1,2
14	15	0,3	1,2
14	20	0,3	1,2
14	22	0,3	1,2
15	15	0,4	1,2
15	16	0,4	1,2
15	17	0,4	1,2
15	22	0,4	1,2
15	24	0,4	1,2
16	16	0,4	1,2
16	17	0,4	1,2

Table 2 (continued)

$D_w$	$L_w$	$r_s$ min.	$r_s$ max.
16	18	0,4	1,2
16	24	0,4	1,2
16	27	0,4	1,2
17	17	0,4	1,2
17	24	0,4	1,2
18	18	0,4	1,2
18	19	0,4	1,2
18	26	0,4	1,2
18	30	0,4	1,2
19	19	0,4	1,5
19	20	0,4	1,5
19	21	0,4	1,5
19	28	0,4	1,5
19	32	0,4	1,5
20	20	0,4	1,5
20	30	0,4	1,5
21	21	0,5	1,5
21	22	0,5	1,5
21	30	0,5	1,5
21	32	0,5	1,5
22	22	0,5	1,5
22	24	0,5	1,5
22	34	0,5	1,5
23	23	0,5	1,5
23	34	0,5	1,5
24	24	0,5	1,5
24	26	0,5	1,5
24	36	0,5	1,5
24	38	0,5	1,5
25	25	0,5	1,7
25	27	0,5	1,7
25	33,5	0,5	1,7
25	36	0,5	1,7
25	40	0,5	1,7
26	26	0,5	1,7
26	28	0,5	1,7
26	40	0,5	1,7

Table 2 (continued)

$D_w$	$L_w$	$r_s$ min.	$r_s$ max.
26	48	0,5	1,7
28	28	0,6	1,7
28	30	0,6	1,7
28	36	0,6	1,7
28	44	0,6	1,7
28	46	0,6	1,7
30	30	0,6	1,7
30	42	0,6	1,7
30	48	0,6	1,7
30	52	0,6	1,7
32	32	0,6	2,2
32	46	0,6	2,2
32	52	0,6	2,2
34	34	0,6	2,2
34	55	0,6	2,2
34	66	0,6	2,2
36	36	0,7	2,2
36	58	0,7	2,2
38	38	0,7	2,2
38	52	0,7	2,2
38	62	0,7	2,2
40	40	0,7	2,2
40	65	0,7	2,2

## 6 Tolerances

The tolerances of ceramic cylindrical rollers are given in [Table 3](#).

Measurement of roughness profile parameter shall be carried out in accordance with ISO 4288.

NOTE 1 Limits and measuring methods for waviness are subject to agreement between the customer and the supplier.

NOTE 2 Local inhomogeneities in, for example, colour, densification, pressing defects and snowflakes, and cracks inherent to the material and its processing are subject to agreement between the customer and the supplier.

NOTE 3 Local defects originating from machining and handling are subject to agreement between the customer and the supplier.

**Table 3 — Diameter tolerances, roller outside diameter roughness and axial circular runout**

Tolerance values in micrometres

Roller grade	Applicable for single roller				Applicable for roller lot
	$t_{Rw}$	$t_{VDwmp}$	$t_{Ramax}$	$t_{SDw}$	$t_{VDwL}$
G20	0,5	0,8	0,08	6	1
G32	0,8	1,2	0,1	6	1,5
G40	1	1,5	0,13	6	2
G48	1,2	2	0,16	10	2,5
G60	1,5	3	0,16	10	3
G100	2,5	4	0,2	15	5

## 7 Material

The rollers shall be manufactured from silicon nitride material in accordance with ISO 26602.

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## Annex A (informative)

### Roller diameter gauges and sorting principles

#### A.1 Explanation of the terms used

**A.1.1** The explanations given in [A.1.2](#) to [A.1.6](#) are provided to promote a better understanding of the terms used in this annex.

**A.1.2 Roller diameter gauge:** Amount by which the mean diameter of roller diameter gauge lot (see [A.1.3](#)) should differ from the nominal roller diameter, this amount being one of an established series.

NOTE 1 Each roller diameter gauge is a whole multiple of the interval of roller diameter gauge (see [A.1.4](#)) established for the roller grade (see [3.1](#)) in question.

NOTE 2 A roller diameter gauge, in combination with the roller grade and nominal roller diameter, is the most exact roller size specification to be used by the customer for ordering purposes.

**A.1.3 Roller diameter gauge lot:** quantity of rollers of the same roller grade (see [3.1](#)) and nominal dimensions, all with the mean roller diameter in a single plane within the same roller diameter gauge (see [A.1.2](#)).

**A.1.4 Interval of roller diameter gauge:**  $I_{GDw}$ , amount by which the permitted mean diameter of roller diameter gauge lot (see [A.1.3](#)) is divided.

NOTE The interval of roller diameter gauge and diameter gauge is defined subject to agreement between the customer and the supplier.

**A.1.5 Mean diameter of roller diameter gauge lot:**  $D_{wmL}$ , average of  $D_{wmpx}$  observed on the roller diameter gauge lot (see [A.1.3](#)).

NOTE See [Table 1](#) for  $D_{wmpx}$ .

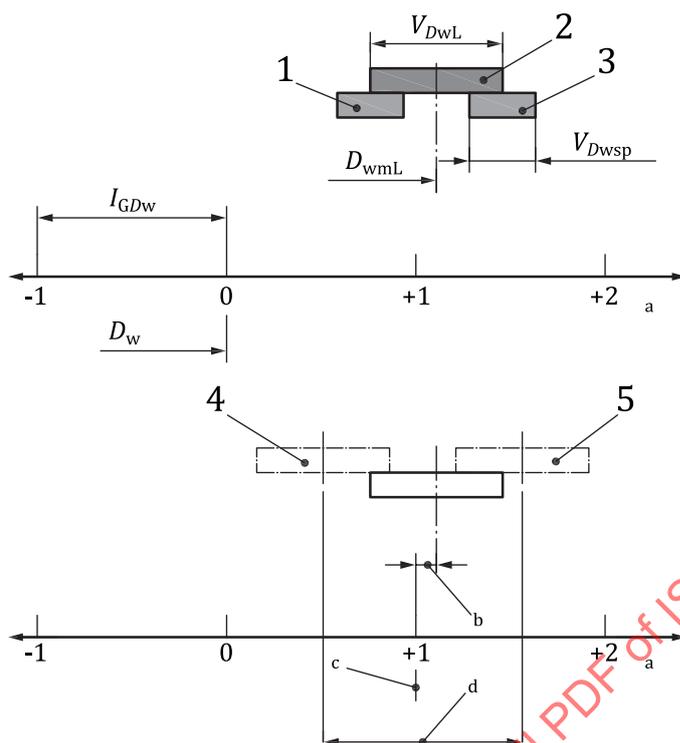
**A.1.6 Variation of roller diameter in a single plane:**  $V_{Dwsp}$ , difference between the largest and the smallest of the single roller diameters in a single radial plane.

NOTE See ISO 5593:1997, 05.05.04.

#### A.2 Roller diameter gauges and sorting principles

[Figure A.1](#) shows an example of the relationship between a roller diameter lot and its diameter gauge with a roller diameter gauge of +1  $\mu\text{m}$ .

Dimensions in micrometres



**Key**

- 1 smallest roller in the roller diameter lot
- 2 roller diameter lot
- 3 largest roller in the roller diameter lot
- 4 roller diameter lot with smallest  $D_{wmL}$  to be related to roller diameter gauge
- 5 roller diameter lot with largest  $D_{wmL}$  to be related to roller diameter gauge
- a Roller diameter gauge scale.
- b Deviation of  $D_{wmL}$  from roller diameter gauge.
- c Roller diameter gauge.
- d Range of mean diameter of roller diameter gauge lot.

**Figure A.1 — Roller diameter gauges and sorting principles**

## Annex B (informative)

### Roller length tolerances, gauges and sorting principles

#### B.1 Terms and definitions

**B.1.1** The explanations given in [B.1.2](#) to [B.1.6](#) are provided to promote a better understanding of the terms used in this annex.

**B.1.2 Roller length gauge:** amount by which the mean length of roller length gauge lot (see [B.1.3](#)) should differ from the nominal roller length, this amount being one of an established series.

NOTE Each roller length gauge is a whole multiple of the interval of roller length gauge (see [B.1.4](#)) established for a certain nominal roller length.

**B.1.3 Roller length gauge lot:** quantity of rollers, all with the mean roller length within the same roller length gauge (see [B.1.2](#)).

**B.1.4 Interval of roller length gauge:**  $I_{GLw}$ , amount by which the permitted mean length of roller length gauge lot (see [B.1.5](#)) is divided.

**B.1.5 Mean length of roller length gauge lot:**  $L_{wml}$ , arithmetical mean of the mean length of the longest roller and the shortest roller length in a roller length gauge lot (see [B.1.3](#)).

**B.1.6 Variation of roller length gauge lot:**  $V_{LwL}$ , difference between the mean length of the roller with the largest length and that of the roller with the smallest length in a roller length gauge lot (see [B.1.3](#)).

#### B.2 Roller length tolerances, gauges and sorting principles

For some radial cylindrical roller bearings, specific application requirements may require the cylindrical rollers assembled in a bearing to be sorted in specific length gauges, as shown in [Table B.1](#) and [Figure B.1](#).

**Table B.1 — Roller length tolerances and length gauges**

$D_w$ mm		$L_w$ mm		$V_{LwL}$ $\mu\text{m}$ max.	$I_{GLw}$ $\mu\text{m}$	Roller length gauge $\mu\text{m}$
>	$\leq$	>	$\leq$			
—	40	—	48	8	6	- 18; - 12; - 6; 0; + 6
		48	—	12	10	- 40; - 30; - 20; - 10; 0; + 10

[Figure B.1](#) shows an example of a roller length lot and its length gauges with a roller length gauge of  $-6 \mu\text{m}$ .