भारतीय मानक **IS/ISO 12297-2 : 2018**

Indian Standard

रोलिंग बियरिंग्स — बेलनाकार रोलर्स

भाग 2 सीमा आयाम, ज्यामितीय उत्पाद विनिर्देश (जीपीएस) और चीनी मिट्टी के रोलर्स के लिए टॉलरेंस मूल्य

Rolling Bearings — Cylindrical Rollers

Part 2 Boundary Dimensions, Geometrical Product Specifications (GPS) and Tolerance Values for Ceramic Rollers

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Bearing Sectional Committee, PGD 13

NATIONAL FOREWORD

This Indian Standard (Part 2) which is identical to ISO 12297-2 : 2018 ‘Rolling bearings — Cylindrical rollers — Part 2: Boundary dimensions, geometrical product specifications (GPS) and tolerance values for ceramic rollers’ issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendation of the Bearing Sectional Committee and approval of the Production and General Engineering Division Council.

This standard is published in two parts. Other part of the series is:

Part 1 Boundary dimensions, geometrical product specifications (GPS) and tolerance values for steel rollers.

The text of ISO standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words ‘International Standard’ appear referring to this standard, they should be read as ‘Indian Standard’; and

b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In this adopted standard, reference appears to the following International Standard for which Indian Standard also exists. The corresponding Indian Standard which is to be substituted in its place is given below along with its degree of equivalence for the edition indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
ISO 4288 Geometrical Product Specifications (GPS) — Surface texture: Profile method — Rules and procedures for the assessment	IS 15263 : 2002/ISO 4288 : 1996 Geometrical product specifications (GPS) — Surface texture : Profile Method — Rules and procedures for the assessment of surface texture	Identical

The Committee has reviewed the provisions of the following International Standard referred in this adopted standard and has decided that it is acceptable for use in conjunction with this standard:

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

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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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.

Indian Standard

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

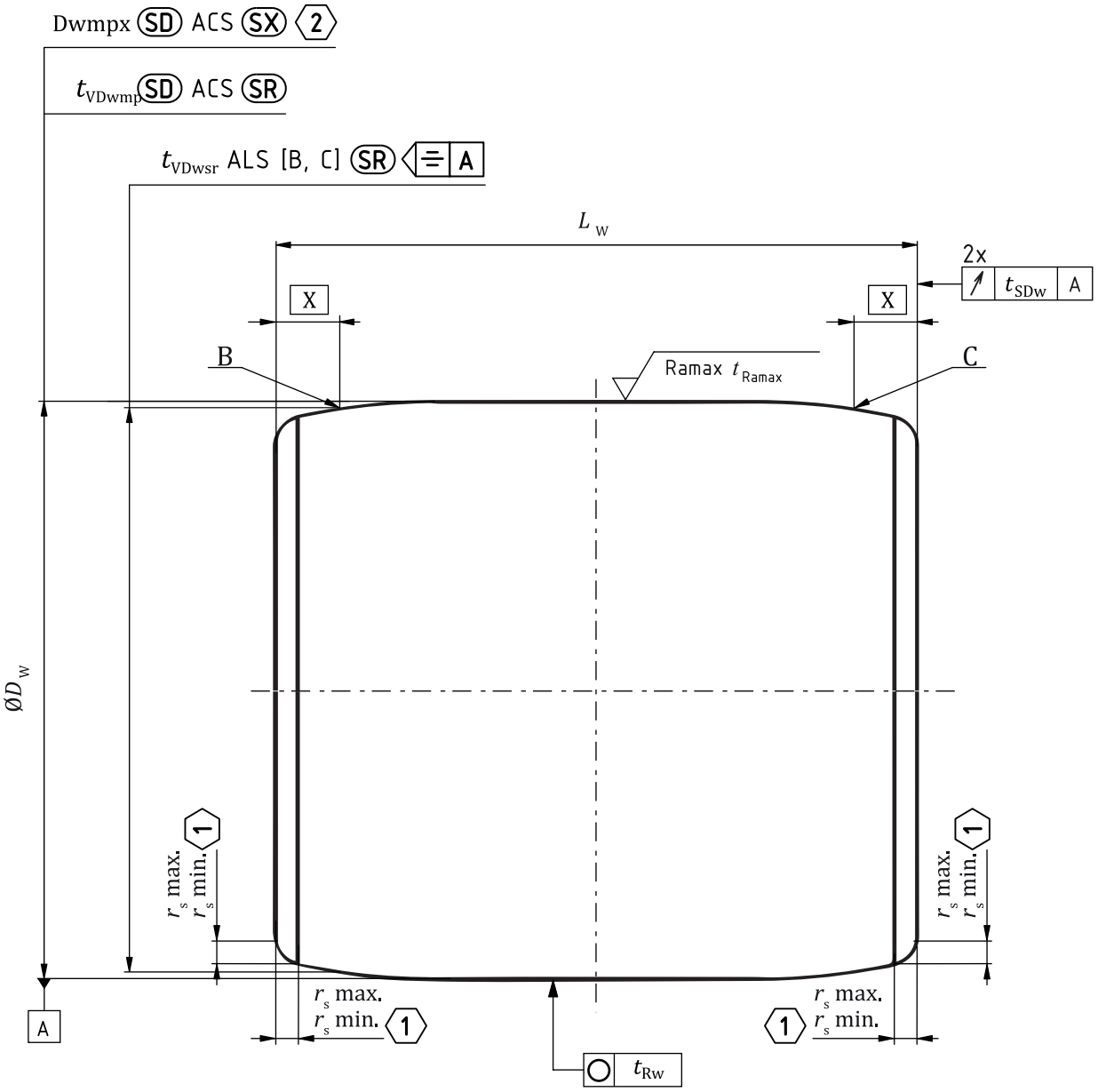
To demonstrate that the ISO GPS system, ISO 8015, has been applied, the dimensional and geometrical characteristics shall be included in the technical product documentation (for example, on the drawing). The dimensional and geometrical specifications associated with these characteristics are described 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
	Dwmpx	(LP) (SD) ACS (SX)	Maximum of mid-range sizes of roller diameter in any cross-section (only to calculate VDwL)
	VDwL		Difference between Dwmpx of the largest and the smallest roller in a lot
	VDwmp	(LP) (SD) ACS (SR)	Range of mid-range sizes (out of two-point sizes) of roller diameter obtained from any cross-sections of cylindrical part of the roller
	VDwsr	(LP) ALS [B,C] (SR) 	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
*Ra*max			Roughness profile parameter
	r_s max.		Largest permissible radial or axial single chamfer dimensions of a roller
	r_s min.		Smallest permissible radial or axial single chamfer dimensions of a roller
	Rw		Roundness of roller
	SDw		Axial circular run-out of a roller end face with respect to datum, i.e. axis, established from the roller's outside surface



Key

1 No roller material is allowed to project beyond an imaginary circular arc, which has a radius r_s min. in an axial plane and is tangential to the roller face and to the outside surface of the roller.

2 Characteristic used only to calculate VDwL for a roller lot.

NOTE Distance "X" from the end of the roller and t_{VDwsr} are subject to agreement between the customer and the supplier

Figure 1 — Ceramic cylindrical roller

5 Dimensions

The nominal dimensions of the ceramic cylindrical rollers are given in Table 2.

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}	$t_{Ra\max}$	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.

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 Dwmpx observed on the roller diameter gauge lot (see A.1.3).

NOTE See Table 1 for Dwmpx.

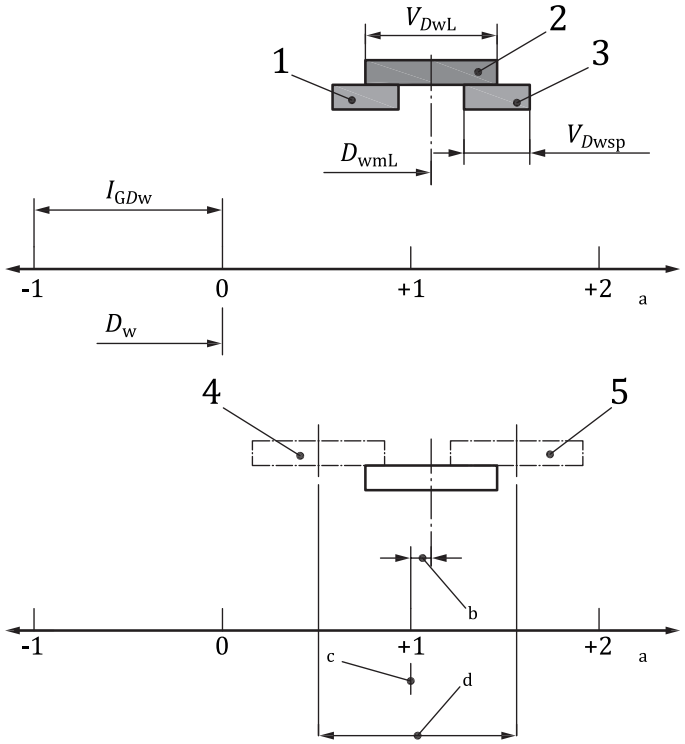
A.1.6 Variation of roller diameter in a single plane: V_{Dwsp}, difference between the largest and the smallest of the single roller diameters in a single radial plane.

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 µm.

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

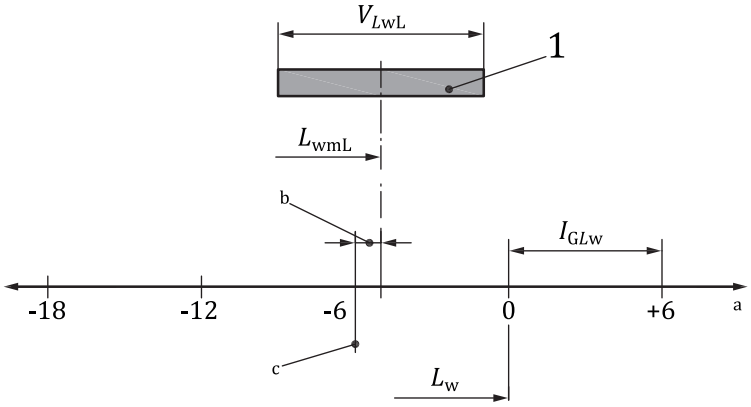
For some radial cylindrical roller bearings, specific application requirements may require the cylindrical rollers assembled in a bearing to be sorted in specific length gauges, as shown in Table B.1 and Figure B.1.

Table B.1 — Roller length tolerances and length gauges

D_w mm		L_w mm		V_{LwL} µm	I_{GLw} µm	**Roller length gauge** µm
>	≤	>	≤	max.		
—	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 µm.

Dimensions in micrometres



Key

1 roller length lot

a Roller length gauge scale.

b Deviation of L_{wmL} from roller length gauge.

c Roller length gauge.

Figure B.1 — Roller length gauges and sorting principles

Annex C
(informative)

Examples of imperfection types and methods of inspection

C.1 General

The imperfections listed in C.3.1 may exist in silicon nitride bearing rollers. Methods for their inspection/detection are listed in C.3.2.

C.2 Terms and definitions

C.2.1 The explanation given in C.2.2 is provided to promote a better understanding of the terms used in this annex.

C.2.2 Surface imperfection: Element, irregularity or group of elements and irregularities of the real surface unintentionally or accidentally caused during manufacture, storage or use of the surface. (See ISO 8785:1998, 2.4, modified – the notes have been replaced).

NOTE 1 These types of element or irregularity differ considerably from those constituting the roughness profile and are not considered during the measurement of the roughness profile.

NOTE 2 The limits for surface imperfection are not specified in this document.

C.3 Imperfections

C.3.1 Types of imperfection

The types of defect are as follows:

— inclusions;

— porosity;

— pits;

— scratches;

— nicks;

— scuffs;

— cracks;

— colour variations.

C.3.2 Methods of inspection

The methods of inspection could be as follows:

— visual white light (with or without artificial magnification);

— fluorescent penetrant inspection (FPI) (with or without artificial magnification);

— ultrasonic inspection;

— X-Ray tomography;

— laser method.

NOTE The following methods are currently being developed, but still require extensive evaluation before being deemed applicable:

a) resonance inspection (resonant ultrasound spectroscopy);

b) Raleigh wave;

c) acoustic microscopy.

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[1] ISO 1132-1, *Rolling bearings — Tolerances — Part 1: Terms and definitions*

[2] ISO 4291, *Methods for the assessment of departure from roundness — Measurement of variations in radius*

[3] ISO 5593, *Rolling bearings — Vocabulary*

[4] ISO 8015, *Geometrical product specifications (GPS) — Fundamentals — Concepts, principles and rules*

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[9] ISO 14253-1, *Geometrical product specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 1: Decision rules for proving conformity or nonconformity with specifications*

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[11] ISO 14638, *Geometrical product specifications (GPS) — Matrix model*

[12] ISO 15241, *Rolling bearings — Symbols for physical quantities*

[13] ISO/TS 17863, *Geometrical product specification (GPS) — Tolerancing of moveable assemblies*

1) Under preparation. Stage at the time of publication: ISO/NP 12297-1.

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