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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by The Japan Bearing Industrial Association (JBIA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently, JIS B 1501:1988 is replaced with this Standard.

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Rolling bearings — Balls

Introduction

This Japanese Industrial Standard has been prepared based on the third edition of **ISO 3290** published in 2001 without any modifications of the technical contents for the portions (normative references, terms and definitions, and requirements) relating to the corresponding International Standard. For the requirements not given in the said International Standard are added as JIS.

The portions given sidelines or dotted underlines and Annex JA to Annex JC are the matters not given in the corresponding International Standard. A list of modifications with the explanations is given in Annex JC.

1 Scope

This Standard specifies the requirements for the balls for rolling bearings.

NOTE : The International Standard corresponding to this Standard is as follows.

ISO 3290 : 2001 *Rolling bearings — Balls — Dimensions and tolerances* (MOD)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and JIS are IDT (identical), MOD (modified), and NEQ (not equivalent) according to ISO/IEC Guide 21.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. For standards indicated below, only the editions of the indicated year shall be applied and any revisions (including amendments) made thereafter shall not be applied.

JIS B 0104 1991 *Rolling bearings — Vocabulary*

NOTE : Corresponding International Standard : ISO 5593 : 1984 *Rolling bearings — Vocabulary* (MOD)

JIS B 0124 2009 *Rolling bearings — Symbols for quantities*

NOTE : Corresponding International Standard : ISO 15241 : 2001 *Rolling bearings — Symbols for quantities* (MOD)

JIS B 0633 2001 *Geometrical Product Specifications (GPS) — Surface texture : Profile method — Rules and procedures for the assessment of*

surface texture

NOTE : Corresponding International Standard : **ISO 4288** : 1996 *Geometrical Product Specifications (GPS) — Surface texture : Profile method — Rules and procedures for the assessment of surface texture* (IDT)

JIS B 0651 : 2001 *Geometrical Product Specifications (GPS) — Surface texture : Profile method — Nominal characteristics of contact (stylus) instruments*

JIS B 1515-1: 2006 *Rolling bearings — Tolerances — Part 1 : Terms and definitions*

NOTE : Corresponding International Standard : **ISO 1132-1** : 2000 *Rolling bearings Tolerances Part 1 : Terms and definitions* (IDT)

JIS B 7451 : 1997 *Instruments for the assessment of departure from roundness — Measurement of variations in radius*

NOTE : Corresponding International Standard : **ISO 4291** : 1985 *Methods for the assessment of departure from roundness — Measurement of variations in radius* (MOD)

JIS G 4805 : 1999 *High carbon chromium bearing steels*

JIS Z 2244 : 2003 *Vickers hardness test — Test method*

JIS Z 2245 : 2005 *Rockwell hardness test — Test method*

3 Terms and definitions

For the purposes of this Standard, the terms and definitions given in JIS B 0104, JIS B 0124 and JIS B 1515-1, and the following definitions apply.

3.1 nominal dimension

designation generally used to show that the diameter of ball is equal

The nominal dimension in millimetre series shall be expressed by adding "mm" to "nominal ball diameter" (e.g., 0.3 mm), and that in inch series shall be expressed by "corresponding dimension in inch" (e.g., 1/64). The preferred nominal dimensions are shown in table 1.

3.2 nominal ball diameter D_w

value that the nominal dimension is expressed in unit of mm

3.3 single ball diameter D_{ws}

distance between two parallel planes tangential to the actual surface of a ball

3.4 mean ball diameter D_{wm}

arithmetical mean value of the largest and the smallest single ball diameters of a ball

3.5 variation of ball diameter V_{Dws}

difference between the largest and the smallest single ball diameters of a ball

3.6 surface irregularities and form parameters

deviation from the perfect spherical ball surface, uniformly distributed and repeated around the ball surface

NOTE : The following can be attributed as the form parameters.

- deviation from spherical form
- waviness
- surface roughness

3.6.1 deviation from spherical form

radial difference between the smallest circumscribed sphere and the greatest inscribed sphere with their centres common to the least square sphere centre

3.6.2 waviness

random or periodical surface undulations from the ideal spherical form

3.6.3 surface roughness

surface irregularities with relatively small spacings resulting from the manufacturing method and/or other influences

The surface roughness shall be expressed by the arithmetical mean of roughness (R_a).

3.7 surface defect

flaw of the real surface, irregularity or group of them accidentally caused during manufacture, storage, handling or use

NOTE : These types of flaw or irregularity differ from those constituting the surface roughness and should not be considered during the measurement of the surface roughness. Surface defects (and their limits) are not specified in this Standard.

3.8 ball lot

balls of definite quantity manufactured under conditions presumed uniform and treated as an entity

3.9 mean diameter of ball lot D_{wL}

arithmetical mean value of the mean ball diameter of the largest ball and the mean ball diameter of the smallest ball in a ball lot

3.10 variation of ball lot diameter V_{DwL}

difference between the mean ball diameter of the largest ball and the mean ball diameter of the smallest ball in a ball lot

3.11 ball grade G

specific division for dimension, form, surface roughness and tolerances on gauge inter-

val (see table 2 and table 3)

NOTE : The ball grade shall be identified by the Latin letter G and Arabic numbers.

3.12 ball gauge S

deviation between the mean diameter of ball lot and the nominal ball diameter and one of the series established for each ball grade

NOTE 1 Each ball gauge is an integral multiple of the ball gauge interval established for the corresponding ball grade (see table 3 and Annex B).

NOTE 2 A ball gauge in combination with the ball grade and the nominal ball diameter shall be considered on the accurate determination of the ball specification by a customer.

3.13 deviation of a ball lot from ball gauge Δ_s

value of the sum of nominal ball diameter and ball gauge subtracted from the mean diameter of ball lot (see table 3 and figure B.2)

$$\Delta_s = D_{\text{wmL}} - (D_w + S)$$

3.14 ball subgauge

value of the series established, which is nearest to the difference between the mean diameter of ball lot and ball gauge

NOTE 1 Each ball subgauge is an integral multiple of the ball subgauge interval established for the corresponding ball grade (see table 3 and Annex B).

NOTE 2 The ball subgauge, in combination with the nominal ball diameter and the ball gauge, shall be used to show the mean diameter of ball lot by manufacturers.

3.15 hardness

degree of resistance to penetration by indenter determined by the specific method

4 Requirements

4.1 Dimensions

The preferred dimensions (nominal dimensions) shall be in accordance with table 1.

4.2 Quality of geometry and surface

The quality of geometry and surface shall be as follows.

- The variation of ball diameter shall be in accordance with table 2.
- The deviation from spherical form shall be in accordance with table 2.
- The allowable limit value and the measurement method of waviness shall be upon the consultation between the customer and the supplier.
- The surface roughness shall be in accordance with table 2.

- The surface appearance, defects and the like shall be upon the consultation between the customer and the supplier.

4.3 Ball grade and ball gauge

The variation of ball lot diameter, gauge interval, preferred gauge, subgauge interval and subgauge shall be in accordance with table 3.

4.4 Hardness

~~The hardness of ball shall be in accordance with table 4.~~

5 Material

The material of ball shall be in accordance with JIS G 4805.

6 Measuring method

6.1 Mean ball diameter and variation of ball diameter

The diameter necessary for determining the mean ball diameter and the variation of ball diameter shall be measured with the ball placed between the plane for measurement and the stylus applied vertical to it from different directions for ten times or more in general.

The mean ball diameter shall be obtained in the form of the arithmetic mean value of the largest and the smallest thereof, and the variation of ball diameter shall be obtained in the form of the difference between the largest and the smallest thereof.

In this case, the measuring force shall be 3 N or under. For the ball of which the nominal dimension is 0.3 mm to 3 mm, rather smaller measuring force is preferable.

NOTE : The mean ball diameter shall generally be corrected by taking into account the contact elasticity amount due to the measuring force and the ball mass. See Annex JB for the correction method.

6.2 Deviation from spherical form

The assessment method of deviation from spherical form of ball shall be in accordance with Annex A.

6.3 Waviness

It is preferable to evaluate the waviness as the velocity amplitude. The waviness component on the surface of the ball shall generally be measured by the waviness metre with filters.

6.4 Surface roughness (R_a)

For the surface roughness of the ball, the measurement instrument specified in JIS B 0651 shall be used and the assessment method and procedure shall be in accordance with JIS B 0633.

6.5 Variation of ball lot diameter and ball gauge

The variation of ball lot diameter shall be obtained by the difference between the mean ball diameter of the largest ball and that of the smallest ball in a lot.

The ball gauge shall be obtained as the value which is the nearest preferred gauge specified in table 3 for the difference of the mean diameters of ball lot.

6.6 Hardness

The measurement of hardness for the ball of which the nominal dimension is 3 mm or under shall be in accordance with JIS Z 2244. The measurement of hardness for the ball of which the nominal dimension is over 3 mm shall be in accordance with JIS Z 2245.

When measuring the hardness of the ball on the sphere directly, it is necessary that the tip of indenter, centre of ball, and centre of tapered seat shall be in line with the indenter holding spindle. The misalignment of centre of spindle shall degrade the reading of hardness, especially for the smaller ball.

When the hardness of ball is measured on the sphere directly, the apparent hardness shall be corrected in accordance with Annex JA.

7 Inspection

The inspection of the ball shall be carried out in accordance with clause 6 and the results shall satisfy clause 4.

8 Designation

The designation of ball shall be in accordance with the name, nominal dimension, ball gauge and ball grade.

Example 1: Ball for rolling bearings 3 mm + 3 μ m G 10

Example 2: Ball for rolling bearings 3/8 - 4 μ m G 40

9 Packaging and marking

9.1 Packaging

The ball shall be given the anticorrosive treatment by applying grease or others, and shall be packed in a suitable container.

9.2 Marking

The container shall be marked with at least the following items on its surface. The contents of marking shall be upon the consultation between the customer and the supplier.

— Name