INTERNATIONAL STANDARD

ISO 14728-2

Second edition
2017-02

Rolling bearings — Linear motion rolling bearings —

Part 2: Static load ratings

Roulements — Roulements à mouvement linéaire —

Partie 2: Charges statiques de base

Reference number
ISO 14728-2:2017(E)

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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).

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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 4, *Rolling bearings*, Subcommittee SC 8, *Load ratings and life*.

This second edition cancels and replaces the first edition (ISO 14728-2:2004), of which it constitutes a minor revision with the following changes:

— improvement of Figures 2, 4, 8 and 9;

— correction of formula for k_{0i} in Formula (1);

— alignment with the latest drafting rules.

A list of all parts in the ISO 14728 series can be found on the ISO website.

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Introduction

It is often impractical to establish the suitability of a linear motion rolling bearing selected for a specific application by testing. The following procedures have proved to be an appropriate and convenient substitute for testing:

— life calculation with dynamic load (ISO 14728-1);

— static load safety factor calculation with static load (ISO 14728-2).

Permanent deformation appears in rolling elements and raceways of rolling bearings under static loads of moderate magnitude and increases gradually with increasing load.

It is often impractical to establish whether the deformation appearing in a bearing in a specific application is permissible by testing the bearing in that application. Other methods are therefore required to establish the suitability of the bearing selected.

Experience shows that a total permanent deformation of 0,000 1 of the rolling element diameter, at the centre of the most heavily loaded rolling element/raceway contact, can be tolerated in most bearing applications without the subsequent bearing operation being impaired. The basic static load rating is, therefore, given a magnitude such that approximately that degree of deformation occurs when the static equivalent load is equal to the load rating.

Tests in different countries indicate that a load of the magnitude in question may be considered to correspond to a calculated contact stress of

— 5 300 MPa for recirculating linear ball bearings, sleeve type,

— 4 200 MPa to 4 600 MPa for recirculating linear ball bearings, linear guideway type (see 3.9 and Table 1),

— 4 200 MPa to 4 600 MPa for non-recirculating linear ball bearings (see 3.9 and Table 1), and

— 4 000 MPa for linear roller bearings,

at the centre of the most heavily loaded rolling element/raceway contact. The formulae and factors for the calculation of the basic static load ratings are based on these contact stresses.

The permissible static equivalent load may be smaller than, equal to or greater than the basic static load rating, depending on the requirements for smoothness of operation and friction, as well as on actual contact surface geometry. Bearing users without previous experience of these conditions should consult the bearing manufacturers.

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Rolling bearings — Linear motion rolling bearings —

Part 2:
Static load ratings

1 Scope

This document specifies methods of calculating the basic static load rating, static equivalent load and static safety factor for linear motion rolling bearings manufactured from contemporary, commonly used, high quality, hardened bearing steel in accordance with good manufacturing practice and basically of conventional design with regard to the shape of the rolling contact surfaces.

This document is not applicable to designs where the rolling elements operate directly on the slide surface of the machine equipment, unless that surface is equivalent in all respects to the raceway of the linear motion rolling bearing component it replaces.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 76 and ISO 5593, and the following apply.

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

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
recirculating linear ball bearing, sleeve type, with or without raceway grooves
basically cylindrical sleeve provided with a number of closed loops of recirculating balls designed to achieve linear rolling motion along a hardened cylindrical shaft

Note 1 to entry: See Figure 1.

Note 2 to entry: The raceways in the sleeve can be designed cylindrical as well as steel inserts with raceway grooves parallel to the axis.

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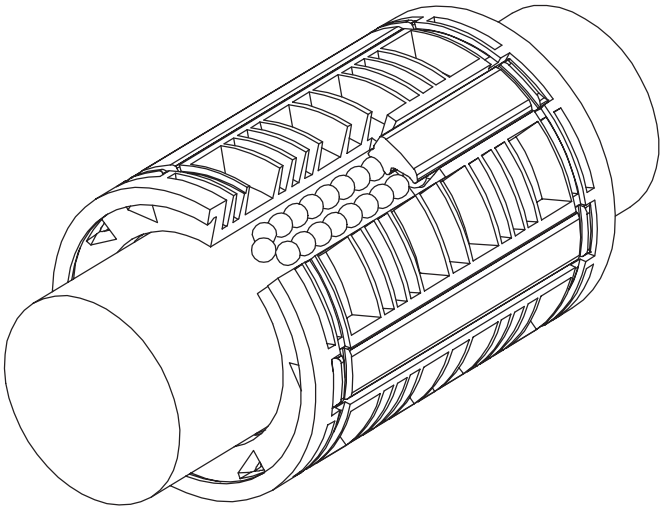


Figure 1 — Recirculating linear ball bearing, sleeve type

3.2
recirculating linear ball (or roller) bearing, linear guideway, carriage type
linear ball (or roller) bearing provided with a number of symmetrically arranged, closed loops of recirculating balls (or rollers) designed to achieve linear rolling motion along a hardened guideway furnished with adequate raceways

Note 1 to entry: See Figure 2.

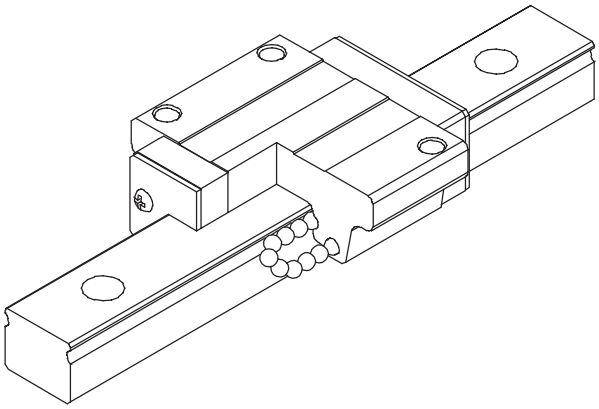


Figure 2 — Recirculating linear ball (or roller) bearing, linear guideway, carriage type

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3.3
non-recirculating linear ball bearing, linear guideway, deep groove type
linear bearing with balls as rolling elements, each ball having two points of contact

Note 1 to entry: See Figure 3.

Note 2 to entry: The cross-sectional radii of the raceway grooves in the two guideways are equal and may lie between 0,52 D_w and infinity.

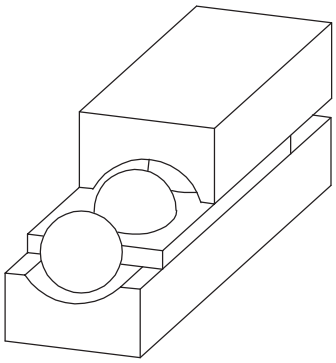


Figure 3 — Non-recirculating linear ball bearing, linear guideway, deep groove type

3.4
non-recirculating linear ball bearing, linear guideway, four-point-contact type
linear bearing with balls as rolling elements, each ball having four points of contact

Note 1 to entry: See Figure 4.

Note 2 to entry: The cross-sectional radii of the raceway grooves for the four points of contact in the two guideways are equal and may lie between 0,52 D_w and infinity.

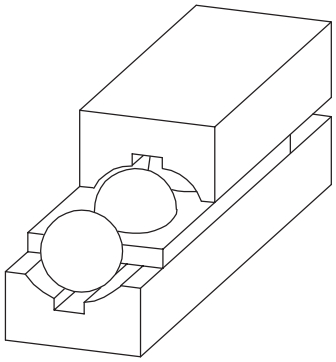


Figure 4 — Non-recirculating linear ball bearing, linear guideway, four-point-contact type

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3.5
non-recirculating linear roller bearing, linear guideway, flat type
linear bearing with needle rollers or cylindrical rollers as rolling elements

Note 1 to entry: See Figure 5.

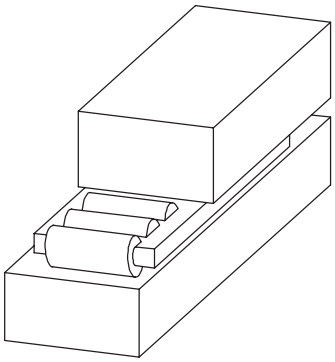


Figure 5 — Non-recirculating linear roller bearing, linear guideway, flat type

3.6
non-recirculating linear roller bearing, linear guideway, V-angle type
linear bearing with guideways designed as parts of a V with a 90° angle

Note 1 to entry: See Figure 6.

Note 2 to entry: Needle rollers or cylindrical rollers are used as rolling elements.

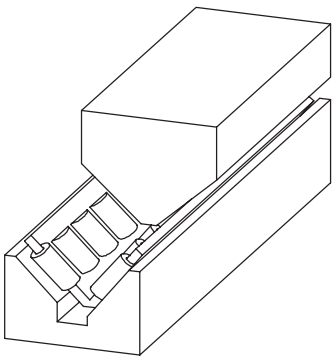


Figure 6 — Non-recirculating linear roller bearing, linear guideway, V-angle type

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3.7
non-recirculating linear roller bearing, linear guideway, crossed roller type
linear bearing with cylindrical rollers arranged in a crossed roller construction

Note 1 to entry: See Figure 7.

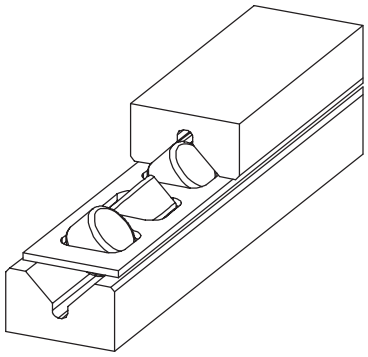


Figure 7 — Non-recirculating linear roller bearing, linear guideway, crossed roller type

3.8
static safety factor
ratio between the basic static load rating and the static equivalent load giving the margin of safety against inadmissible permanent deformation on rolling elements and raceways

3.9
basic static load rating of a linear motion rolling bearing
static load which corresponds to a calculated contact stress σ_{max} at the centre of the most heavily loaded rolling element or raceway contact

Note 1 to entry: For this contact stress, a total permanent deformation of rolling element and raceway occurs which is approximately 0,000 1 of the rolling element diameter.

— For a recirculating linear ball bearing, sleeve type: σ_{max} = 5 300 MPa;

— For a recirculating linear ball bearing, linear guideway type: see Table 1;

— For a non-recirculating linear ball bearing: see Table 1;

— For a linear roller bearing: σ_{max} = 4 000 MPa.

Table 1 — Contact stress, σ_{max}

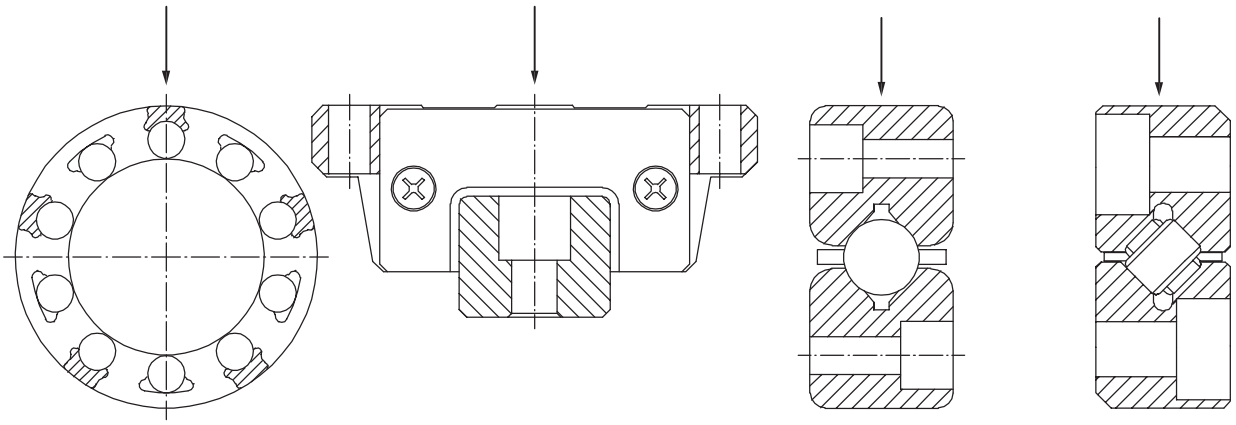
r_g (mm)	≤0,52 D_w	0,53 D_w	0,54 D_w	0,55 D_w	0,56 D_w	0,57 D_w	0,58 D_w	0,59 D_w	≥0,6 D_w
σ_{max} (MPa)	4 200	4 250	4 300	4 350	4 400	4 450	4 500	4 550	4 600

3.10
static equivalent load
static load that causes the same contact stress at the centre of the most heavily loaded rolling element or raceway contact as the stress that occurs under the actual load conditions

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3.11
direction of load
direction of load applied for load rating calculation

Note 1 to entry: For calculation of basic static load ratings, the direction of the load is defined for all linear motion bearings as shown by the arrows in Figure 8.



Rolling bearing defined in			
3.1	3.2	3.4	3.7

Figure 8 — Direction of load

3.12
pitch diameter
<of recirculating linear ball bearing, sleeve type> diameter of the circle containing the centres of the balls in contact with the raceways, in a cross-sectional plane perpendicular to the bearing axis

3.13
nominal contact angle
angle between the direction of load on the linear bearing and the nominal line of action of the resultant of the forces transmitted by a bearing raceway member to a rolling element

Note 1 to entry: See Figure 9.

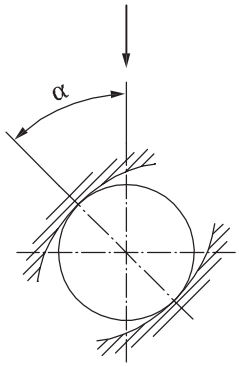


Figure 9 — Nominal contact angle

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