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Spherical plain bearings — Method for the calculation of static and dynamic load ratings

Rotules lisses — Méthode de calcul des charges statiques et dynamiques de base

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Foreword

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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 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.

This document was prepared by Technical Committee ISO/TC 4, *Rolling bearings*, Subcommittee SC 8, *Load ratings and life*.

Spherical plain bearings — Method for the calculation of static and dynamic load ratings

1 Scope

This document specifies methods of calculating the static load rating and the dynamic load rating for spherical plain bearings within the size ranges shown in ISO 12240-1, ISO 12240-2 and ISO 12240-3.

Rod ends according to ISO 12240-4 are excluded.

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 6811, *Spherical plain bearings — Vocabulary*

ISO 12240-1, *Spherical plain bearings — Part 1: Radial spherical plain bearings*

ISO 12240-2, *Spherical plain bearings — Part 2: Angular contact radial spherical plain bearings*

ISO 12240-3, *Spherical plain bearings — Part 3: Thrust spherical plain bearings*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12240-1, ISO 12240-2, ISO 12240-3 and ISO 6811 and the following apply.

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

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

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

3.1 Static conditions

3.1.1
static load rating
<spherical plain bearings> maximum load that the spherical plain bearing can accommodate at room temperature without inadmissible deforming or damage of the sliding surfaces, when there is no relative movement between the sliding contact surfaces

3.1.2
static radial load rating
C_{0r}
static load rating (3.1.1) when a load is applied on the spherical plain bearing in pure radial direction

3.1.3
static axial load rating
C_{0a}
static load rating (3.1.1) when a load is applied on the spherical plain bearing in pure axial direction

3.2 Dynamic conditions

3.2.1
dynamic load rating
<spherical plain bearings> maximum load that the spherical plain bearing can accommodate at room temperature without inadmissible deforming or damage of the sliding surfaces, when there is relative movement between the sliding contact surfaces

3.2.2
dynamic radial load rating
C_r
dynamic load rating (3.2.1) when a load is applied on the spherical plain bearing in pure radial direction

3.2.3
dynamic axial load rating
C_a
dynamic load rating (3.2.1) when a load is applied on the spherical plain bearing in pure axial direction

4 Symbols and units

For the purposes of this document, the symbols given in ISO 12240-1, ISO 12240-2, ISO 12240-3 and the following apply (see Figures 1, 3 and 5).

B inner ring width, in millimetre (mm)

C outer ring width, in millimetre (mm)

C_a dynamic axial load rating, in newton (N)

C_r dynamic radial load rating, in newton (N)

C_{0a} static axial load rating, in newton (N)

C_{0r} static radial load rating, in newton (N)

D outside diameter, in millimetre (mm)

d bore diameter, in millimetre (mm)

d_k sphere diameter, in millimetre (mm)

f_a factor for the calculation of dynamic axial load ratings of the sliding contact area, which depends on design and material, in newton per square millimetre (MPa)

f_r factor for the calculation of dynamic radial load ratings of the sliding contact area, which depends on design and material, in newton per square millimetre (MPa)

f_{0a} factor for the calculation of static axial load ratings of the sliding contact area, which depends on design and material, in newton per square millimetre (MPa)

f_{0r} factor for the calculation of static radial load ratings of the sliding contact area, which depends on design and material, in newton per square millimetre (MPa)

For angular contact spherical plain bearings and thrust spherical plain bearings, the symbols given in ISO 12240-2, ISO 12240-3 and following symbols apply additionally (see Figures 2 and 4):

D_{S1} smallest diameter of sliding contact surface of the outer ring, in millimetre (mm)

D_{S2} largest diameter of sliding contact surface of the outer ring, in millimetre (mm)

5 Radial spherical plain bearings

5.1 Static radial load rating

For radial spherical plain bearings with dimensions and tolerances in accordance to ISO 12240-1 (see Figure 1), the static radial load rating is calculated by Formula (1):

$$C_{0r} = f_{0r} \cdot C \cdot d_k \tag{1}$$

The value of f_{0r} is not defined in this document, and should be requested from the manufacturer.

The information that is considered in f_{0r} is described in Annex A. A calculation example of static load rating using f_{0r} is described in Annex B.

5.2 Dynamic radial load rating

For radial spherical plain bearings with dimensions and tolerances in accordance to ISO 12240-1 (see Figure 1), the dynamic radial load rating is calculated by Formula (2):

$$C_r = f_r \cdot C \cdot d_k \tag{2}$$

The value of f_r is not defined in this document, and it should be requested from the manufacturer.

The information that is considered in f_r is described in Annex A. A calculation example of dynamic load rating using f_r is described in Annex B.

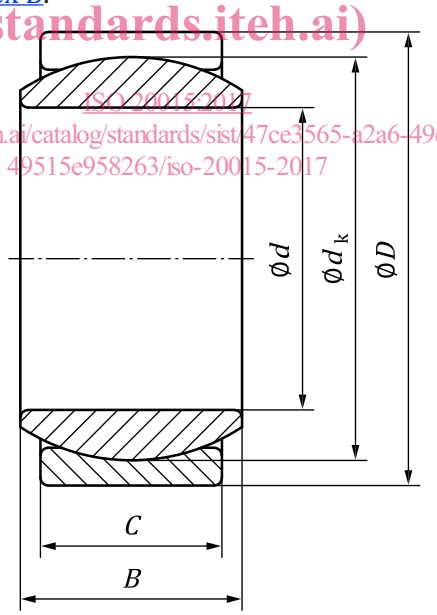

Figure 1 — Scheme of a radial spherical plain bearing

6 Angular contact radial spherical plain bearings

6.1 Static radial load rating

For angular contact radial spherical plain bearings with dimensions and tolerances in accordance to ISO 12240-2 (see Figure 2 and Figure 3), the static radial load rating is calculated by Formula (3):

$$C_{0r} = f_{0r} \cdot C \cdot \frac{D_{s1} + D_{s2}}{2} \tag{3}$$

The value of f_{0r} is not defined in this document, and it should be requested from the manufacturer.

The information that is considered in f_{0r} is described in Annex A.

6.2 Dynamic radial load rating

For angular contact radial spherical plain bearings with dimensions and tolerances in accordance to ISO 12240-2 (see Figure 2 and Figure 3), the dynamic radial load rating is calculated by Formula (4):

$$C_r = f_r \cdot C \cdot \frac{D_{s1} + D_{s2}}{2} \tag{4}$$

The value of f_r is not defined in this document, and it should be requested from the manufacturer.

The information that is considered in f_r is described in Annex A.

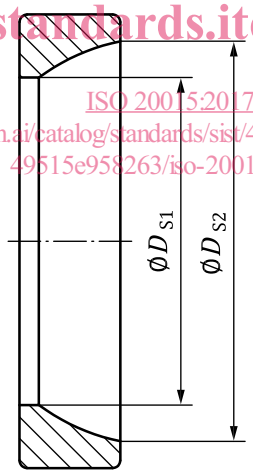

Figure 2 — Scheme of the outer ring of an angular contact spherical plain bearing

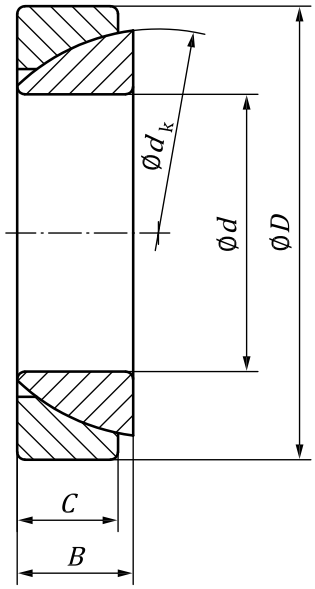

Figure 3 — Scheme of an angular contact spherical plain bearing

7 Thrust spherical plain bearings

7.1 Static axial load rating

For thrust spherical plain bearings with dimensions and tolerances in accordance to ISO 12240-3 (see Figure 4 and Figure 5), the static axial load rating is calculated by Formula (5):

$$C_{0a} = f_{0a} \cdot (D_{s2}{}^2 - D_{s1}{}^2) \cdot \frac{\pi}{4} \quad (5)$$

The value of f_{0a} is not defined in this document, and it should be requested from the manufacturer.

The information that is considered in f_{0a} is described in Annex A.

7.2 Dynamic axial load rating

For thrust spherical plain bearings with dimensions and tolerances in accordance to ISO 12240-3 (see Figure 4 and Figure 5), the dynamic axial load rating is calculated by Formula (6):

$$C_a = f_a \cdot (D_{s2}{}^2 - D_{s1}{}^2) \cdot \frac{\pi}{4} \quad (6)$$

The value of f_a is not defined in this document, and it should be requested from the manufacturer.

The information that is considered in f_a is described in Annex A.