



**SLOVENSKI STANDARD**  
**SIST ISO/TS 16799:2001**  
**01-julij-2001**

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Rolling bearings -- Dynamic load ratings and rating life -- Discontinuities in the calculating of basic dynamic load ratings

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Roulements -- Charges dynamiques de base et durée nominale -- Discontinuité dans le calcul des charges dynamiques de base

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**Rolling bearings — Dynamic load ratings  
and rating life — Discontinuities in the  
calculating of basic dynamic load ratings**

*Roulements — Charges dynamiques de base et durée nominale —  
Discontinuité dans le calcul des charges dynamiques de base*

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

- an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;
- an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed every three years with a view to deciding whether it can be transformed into an International Standard.

Attention is drawn to the possibility that some of the elements of this Technical Specification may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TS 16799 was prepared by Technical Committee ISO/TC 4, *Rolling bearings*, Subcommittee SC 8, *Load ratings and life*.

**ISO/TS 16799:1999(E)****Introduction**

This Technical Specification addresses discontinuities in the calculation of basic dynamic load ratings for radial and thrust angular-contact ball bearings.

The factors used in calculating the basic dynamic load ratings  $C_r$  and  $C_a$  according to ISO 281 are slightly different for radial and thrust angular-contact ball bearings. The methods for taking into account the influence of thrust loads on bearing life are also different.

Therefore there is a discontinuity in the calculated lives when a bearing with the contact angle  $\alpha = 45^\circ$  is first regarded as a radial bearing and then as a thrust bearing. In both cases the bearing is subject to the same external axial load  $F_a$  only.

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# Rolling bearings — Dynamic load ratings and rating life — Discontinuities in the calculating of basic dynamic load ratings

## 1 Scope

This Technical Specification explains why the load rating factors for calculation of the basic dynamic load ratings  $C_r$  and  $C_a$  are different for radial and thrust angular-contact ball bearings, and shows how these load ratings can be recalculated in order to bring about correct comparisons under the same conditions.

## 2 Normative reference

The following normative document contains provisions which, through reference in this text, constitute provisions of this Technical Specification. For dated references, subsequent amendments to, or revisions of, this publication do not apply. However, parties to agreements based on this Technical Specification are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 281:1990, *Rolling bearings — Dynamic load ratings and rating life.*

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## 3 Symbols

For the purposes of this Technical Specification the symbols used in ISO 281 as well as the following apply.

$C_{ar}$  which is the adjusted basic dynamic axial load rating for a radial bearing ( $\alpha \leq 45^\circ$ ), in newtons;

$C_{aa}$  which is the adjusted basic dynamic axial load rating for a thrust bearing ( $\alpha > 45^\circ$ ), in newtons;

$r_i$  which is the cross-sectional raceway groove radius of inner ring, in millimetres;

$r_e$  which is the cross-sectional raceway groove radius of outer ring, in millimetres;

$\lambda$  which is the contact stress factor.

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#### 4 Different factors for calculating load rating and equivalent load for radial and thrust angular-contact ball bearings

When a life comparison is made between a radial and a thrust bearing, both bearings are assumed to be subject to the same external axial load  $F_a$  only.

For angular-contact thrust ball bearings

$$L_{10} = \left( \frac{C_a}{P_a} \right)^3 = \left( \frac{C_a}{F_a} \right)^3$$

Included in the calculation of  $C_a$  are

- the osculation between balls and raceways  $r_i/D_w \leq 0,54$  and  $r_e/D_w \leq 0,54$ ,
- a contact stress factor  $\lambda = 0,9$ ,
- the  $Y$  factor ( $C_a = C_r/Y$ )

where

$$Y = \frac{0,4 \cot \alpha}{1 - 0,333 \sin \alpha} \quad (1)$$

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For angular-contact radial ball bearings (standards.iteh.ai)

$$L_{10} = \left( \frac{C_r}{P_r} \right)^3 = \left( \frac{C_r}{Y F_a} \right)^3 = \left( \frac{C_a}{F_a} \right)^3$$

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Included in the calculation of  $C_r$  are

- the osculation between balls and raceways  $r_i/D_w \leq 0,52$  and  $r_e/D_w \leq 0,53$ ,
- a contact stress factor  $\lambda = 0,95$ .

The  $Y$  factor is calculated according to equation (1) if all balls are loaded, as is mostly the case for thrust bearings. The expression  $1 - 0,333 \sin \alpha$  in equation (1) takes into consideration the negative influence of the fact that all balls are loaded and is included in the  $f_c$  values for angular contact thrust ball bearings in Table 4 of ISO 281:1990.

Radial bearings are mainly radially loaded and many balls are unloaded or lightly loaded. The negative influence of the expression  $1 - 0,333 \sin \alpha$  was therefore reduced when the  $Y$  factors were calculated for angular-contact radial ball bearings in Table 3 of ISO 281:1990.



## 5 Comparing adjusted basic dynamic axial load ratings, $C_{ar}$ and $C_{aa}$ , for radial and thrust angular-contact ball bearings

### 5.1 General

For certain applications angular-contact ball bearings with contact angles  $\alpha \leq 45^\circ$  and  $\alpha > 45^\circ$  are manufactured with the same osculation between balls and raceways, and sometimes there is a need to calculate and also to compare their true axial load ratings.

The basic dynamic load ratings  $C_r$  and  $C_a$  can be calculated with the aid of clauses 5 and 6 of ISO 281:1990 or taken from a bearing catalogue, if they are available there.

However, as described in clause 4,  $C_r$  and  $C_a$  are calculated with different values of osculation,  $\lambda$  factor and  $Y$  factor for radial and thrust bearings. If a correct calculation and comparison is to be made,  $C_r$  and  $C_a$  shall be recalculated to adjusted basic dynamic axial load ratings  $C_{ar}$  and  $C_{aa}$ , based upon the same values of osculation,  $\lambda$  factor and  $Y$  factor.

The recalculation can be performed with the aid of equations (2) to (5) for two different osculations – radial bearing osculation and thrust bearing osculation – as defined in 5.1 and 6.1.1 of ISO 281:1990.

The comparisons are made for thrust ratings only, since this is most convenient.

The contact angle  $\alpha$  is assumed to be constant, independent of the axial load, which means that the accuracy is reduced for bearings with small contact angles, subjected to heavy loads.

### 5.2 Angular-contact ball bearings with radial-bearing osculation

( $r_i/D_w \leq 0,52$  and  $r_e/D_w \leq 0,53$ )

$$C_{ar} = 2,37 \tan \alpha (1 - 0,333 \sin \alpha) C_r \quad (2)$$

$$C_{aa} = 1,24 C_a \quad (3)$$

$$L_{10} = \left( \frac{C_{ar}}{F_a} \right)^3$$

$$L_{10} = \left( \frac{C_{aa}}{F_a} \right)^3$$

### 5.3 Angular-contact ball bearings with thrust-bearing osculation

( $r_i/D_w \leq 0,54$  and  $r_e/D_w \leq 0,54$ )

$$C_{ar} = 1,91 \tan \alpha (1 - 0,333 \sin \alpha) C_r \quad (4)$$

$$C_{aa} = C_a \quad (5)$$