SLOVENSKI STANDARD
SIST ISO 15312:2005

01-januar-2005

Kotalni leģaji - Ocenitev hitrosti segrevanja ï Preraļ un in faktorji

Rolling bearings -- Thermal speed rating -- Calculation and coefficients

Roulements -- Vitesse de référence thermique -- Calculs et facteurs de correction

Ta slovenski standard je istoveten z: **ISO 15312:2003**

ICS:

21.100.20 Kotalni ležaji Rolling bearings

SIST ISO 15312:2005 **en**

INTERNATIONAL STANDARD

ISO 15312

First edition
2003-12-01

Corrected version
2004-09-15

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Roulements — Vitesse de référence thermique — Calculs et facteurs de correction

Reference number
ISO 15312:2003(E)

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Published in Switzerland

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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 2.

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.

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

ISO 15312 was prepared by Technical Committee ISO/TC 4, *Rolling bearings*, Subcommittee SC 8, *Load ratings and life*.

In this corrected version of ISO 15312:2003, the status of both Annex A and Annex B has been changed from normative to informative.

Rolling bearings — Thermal speed rating — Calculation and coefficients

1 Scope

This International Standard defines the thermal speed rating for oil bath lubricated rolling bearings and defines calculation principles for the determination of this parameter. The parameter determined in accordance with this International Standard applies to rolling bearings of the given series and sizes of standard design or of a design that, from a frictional point of view, can be related to a standard design bearing.

In most cases of standard assembly, the permissible temperature determines the maximum operating speed. Heating of the assembly is then generated by the bearing.

Thrust ball bearings are excluded from this International Standard as kinematic effects do not allow the thermal speed rating defined in this International Standard to be applied.

NOTE 1 In Annex A mean values for the coefficients f_{0r} and f_{1r} are given — f_{0r} for calculating viscous losses of oil bath lubricated bearings and f_{1r} for calculating frictional losses of bearings.

NOTE 2 In Annex B the reference conditions for grease lubrication are defined. The reference conditions are chosen such that the thermal speed rating for grease lubrication is identical to that for oil bath lubrication.

2 Normative references

The following referenced documents are indispensable for the application 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 76:1987, *Rolling bearings — Static load ratings*

ISO 1132-1:2000, *Rolling bearings — Tolerances — Part 1: Terms and definitions*

ISO 5593:1997, *Rolling bearings — Vocabulary*

ISO 5753:1991, *Rolling bearings — Radial internal clearance*

ISO 15241:2001, *Rolling bearings — Symbols for quantities*

3 Terms and definitions

For the purposes of this document the terms and definitions given in ISO 1132-1, ISO 5593 and the following apply.

3.1
thermal speed rating
inner ring or shaft washer rotational speed at which equilibrium is reached between the heat generated by the friction in the bearing and the heat flow emitted through the bearing seating (shaft and housing) under the reference conditions

NOTE 1 The thermal speed rating is one among various criteria which permit comparison of the different rolling bearing types and sizes with regard to their suitability for operation at high speed.

NOTE 2 Mechanical and kinematic criteria which could lead to further speed limitations are not taken into account by the thermal speed rating.

3.2
reference conditions
conditions for the thermal speed rating related to

a) the mean temperature of the stationary outer ring or housing washer of the bearing, i.e. the reference temperature, and the mean environmental temperature, i.e. the reference ambient temperature;

b) the factors determining the friction losses in the bearing, such as:

— the magnitude and direction of the bearing load;

— the method of lubrication, type of lubricant, its kinematic viscosity and quantity;

— other general reference conditions;

c) the heat flow emitted from the rolling bearing defined as the product of the "heat emitting reference surface area of the rolling bearing" and the "reference heat flow density specific to the rolling bearing".

NOTE The heat emission under the reference conditions is based on empirical values and represents the heat emission of the real bearing arrangement. It is, however, independent of the real design of the bearing arrangement.

3.3
heat emitting reference surface area
sum of the contact areas, between inner ring (shaft washer) and shaft and between outer ring (housing washer) and housing, through which the heat flow is emitted

3.4
reference load
bearing load, determined by the reference conditions, which causes the load-dependent frictional moment

3.5
reference heat flow
heat flow, emitted by thermal conduction through the heat emitting reference surface, and caused by frictional resistance, when the bearing is operating under the reference conditions

3.6
reference heat flow density
reference heat flow divided by the heat emitting reference surface area

3.7
reference ambient temperature
mean environmental temperature of the bearing arrangement under the reference conditions

3.8
reference temperature
mean temperature of the stationary outer ring or housing washer of the bearing under the reference conditions

4 Symbols and units

For the purposes of this document, the symbols given in ISO 15241 and the following apply.

Table 1 — Symbols and units

Symbol	Term	Unit
A_r	Heat emitting reference surface area	mm^2
B	Width of rolling bearing	mm
C_{0a}	Basic static axial load rating in accordance with ISO 76	N
C_{0r}	Basic static radial load rating in accordance with ISO 76	N
d	Bearing bore diameter	mm
d_m	Mean diameter of rolling bearing $d_m = 0{,}5 \times (D + d)$	mm
d_1	Outside diameter of the inner ring of thrust spherical roller bearing	mm
D	Bearing outside diameter	mm
D_1	Inside diameter of the outer ring of thrust spherical roller bearing	mm
f_{0r}	Coefficient for the load-independent frictional moment for the reference conditions	1
f_{1r}	Coefficient for the load-dependent frictional moment for the reference conditions	1
M_0	Load-independent frictional moment	N·mm
M_{0r}	Load-independent frictional moment under the reference conditions at the thermal speed rating, $n_{\theta\,r}$	N·mm
M_1	Load-dependent frictional moment	N·mm
M_{1r}	Load-dependent frictional moment under the reference conditions at the thermal speed rating, $n_{\theta r}$	N·mm
$n_{\theta\,r}$	Thermal speed rating	min^{-1}
N_r	Bearing power loss under the reference conditions at the thermal speed rating, $n_{\theta r}$	W
P_{1r}	Reference load	N
q_r	Reference heat flow density	W/mm^2
T	Total width of tapered roller bearing	mm
α	Contact angle	°
θ_{Ar}	Reference ambient temperature	°C
θ_r	Reference temperature	°C
ν_r	Kinematic viscosity of the lubricant under the reference conditions (at the reference temperature, θ_r, of the rolling bearing)	mm^2/s
Φ_r	Reference heat flow	W