

Method of calculating

Dynamic load ratings and rating life of rolling bearings

Committees responsible for this British Standard

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- Advanced Manufacturing Technology Research Institute
- Ball and Roller Bearing Manufacturers' Association
- Institution of Production Engineers
- Ministry of Defence
- North East Coast Institution of Engineers and Shipbuilders
- Society of British Aerospace Companies Ltd.

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National foreword

This British Standard has been prepared under the direction of the Machinery and Components Standards Policy Committee. It is identical with ISO 281:1990 “*Rolling bearings — Dynamic load ratings and rating life*”, published by the International Organization for Standardization (ISO). BS 5512:1991 supersedes BS 5512-1:1977, which is withdrawn.

Cross-references

International standard	Corresponding British Standard
ISO 76:1987	BS 5645:1987 <i>Specification for static load ratings for rolling bearings</i> (Identical)
ISO 5593:1984	BS 6560:1984 <i>Glossary of terms for rolling bearings</i> (Identical)

The international standard has an introduction which is as follows.

“It is often impractical to establish the suitability of a bearing selected for a specific application by testing a sufficient number of bearings in that application. However, life (as defined in **3.1**) is a primary representation of the suitability. A reliable life calculation is therefore considered to be an appropriate and convenient substitute for testing. The purpose of this International Standard is to provide the required basis for life calculation.

The present state of knowledge does not enable this International Standard to include specific values of the life adjustment factors for special bearing properties and operating conditions. Values of these factors must therefore be decided on the basis of experience, usually in consultation with the bearing manufacturer.

Calculations according to this International Standard do not yield satisfactory results for bearings subjected to such application conditions and/or of such internal design which result in considerable truncation of the area of contact between the rolling elements and the ring raceways. Unmodified calculation results are thus not applicable, for example, to groove ball bearings with filling slots which project substantially into the ball/raceway contact area when the bearing is subjected to load in the application.

Calculations according to this International Standard do not yield satisfactory results for bearings subjected to such application conditions which cause deviations from a normal load distribution in the bearing, for example misalignment, housing or shaft deflection, rolling element centrifugal forces or other high speed effects, and preload or extra large clearance in radial bearings. Where there is reason to assume that such conditions prevail, the user should consult the bearing manufacturer for recommendations and evaluation of equivalent load and life.

Revisions of this International Standard will be required from time to time, as the result of new developments or in the light of new information concerning specific bearing types and materials.

Detailed background information regarding the deviation of formulae and factors given in this International Standard may be found in ISO/TR 8646.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 18, an inside back cover and a back cover.

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1 Scope

This International Standard specifies methods of calculating the basic dynamic load rating of rolling bearings within the size ranges shown in the relevant ISO publications, manufactured from contemporary, commonly used, good quality hardened steel in accordance with good manufacturing practice and basically of conventional design as regards the shape of rolling contact surfaces.

This International Standard also specifies methods of calculating the basic rating life, which is the life associated with 90 % reliability, with commonly used material and manufacturing quality, and with conventional operating conditions. In addition, it specifies methods of calculating adjusted rating life, in which various reliabilities, special bearing properties and specific operating conditions are taken into account by means of life adjustment factors.

This International Standard is not applicable to designs where the rolling elements operate directly on a shaft or housing surface, unless that surface is equivalent in all respects to the bearing ring (or washer) raceway it replaces.

Double row radial bearings and double direction thrust bearings are, when referred to in this International Standard, presumed to be symmetrical.

Further limitations concerning particular types of bearings are included in the relevant clauses.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 76:1987, *Rolling bearings — Static load ratings*.

ISO 5593:1984, *Rolling bearings — Vocabulary*.

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 5593, together with the following, apply.

3.1

life

for an individual rolling bearing, the number of revolutions which one of the bearing rings (or washers) makes in relation to the other ring (or washer) before the first evidence of fatigue develops in the material of one of the rings (or washers) or rolling elements

3.2

reliability (in the context of bearing life)

for a group of apparently identical rolling bearings, operating under the same conditions, the percentage of the group that is expected to attain or exceed a specified life

the reliability of an individual rolling bearing is the probability that the bearing will attain or exceed a specified life

3.3

basic rating life

for an individual rolling bearing, or a group of apparently identical rolling bearings operating under the same conditions, the life associated with 90 % reliability with contemporary, commonly used material and manufacturing quality, and under conventional operating conditions

3.4

adjusted rating life

the rating life obtained by adjustment of the basic rating life for a desired reliability level, special bearing properties and specific operating conditions

3.5

basic dynamic radial load rating

that constant stationary radial load which a rolling bearing could theoretically endure for a basic rating life of one million revolutions

in the case of a single row angular contact bearing, the radial load rating refers to the radial component of that load which causes a purely radial displacement of the bearing rings in relation to each other

3.6

basic dynamic axial load rating

that constant centric axial load which a rolling bearing could theoretically endure for a basic rating life of one million revolutions

3.7

dynamic equivalent radial load

that constant stationary radial load under the influence of which a rolling bearing would have the same life as it will attain under the actual load conditions

3.8

dynamic equivalent axial load

that constant centric axial load under the influence of which a rolling bearing would have the same life as it will attain under the actual load conditions

3.9

roller diameter applicable in the calculation of load ratings

the diameter at the middle of the roller

NOTE For a tapered roller this is equal to the mean value of the diameters at the theoretically sharp corners at the large end and at the small end of the roller.

For an asymmetrical convex roller this is an approximation of the diameter at the point of contact between the roller and the ribless raceway at zero load.

3.10

roller length applicable in the calculation of load ratings

the theoretical maximum length of contact between a roller and that raceway where the contact is shortest

NOTE This is normally taken to be either the distance between the theoretically sharp corners of the roller minus the roller chamfers or the raceway width excluding the grinding undercuts, whichever is the smaller.

3.11

nominal contact angle

the angle between a plane perpendicular to the bearing axis and the nominal line of action of the resultant of the forces transmitted by a bearing ring to a rolling element

3.12

pitch diameter of a ball set

the diameter of the circle containing the centres of the balls in one row in a bearing

3.13

pitch diameter of a roller set

the diameter of the circle intersecting the roller axes at the middle of the rollers in one row in a bearing

3.14

conventional operating conditions

conditions which may be assumed to prevail for a bearing which is properly mounted and protected from foreign matter, adequately lubricated, conventionally loaded, not exposed to extreme temperature and not run at exceptionally low or high speed