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Rolling bearings — Dynamic load ratings and rating life — Part I : Calculation methods

*Roulements — Charges dynamiques de base et durée nominale —
Partie I : Méthodes de calcul*

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 281/1 was developed by Technical Committee ISO/TC 4, *Rolling bearings*, and was circulated to the member bodies in January 1976.

It has been approved by the member bodies of the following countries :

Australia	Italy	Sweden
Bulgaria	Japan	Switzerland
Canada	Korea, Rep. of	Turkey
Chile	Mexico	United Kingdom
Czechoslovakia	Netherlands	U.S.A.
France	Poland	U.S.S.R.
Germany	Romania	Yugoslavia
Hungary	South Africa, Rep. of	
India	Spain	

The member body of the following country expressed disapproval of the document on technical grounds :

Austria

This International Standard cancels and replaces ISO Recommendation R 281-1962, of which it constitutes a technical revision.

In the Introductory Note to ISO/R 281-1962, *Rolling bearings – Methods of evaluating dynamic load ratings*, it was stated that “it is recognised that revisions of the calculations may be required from time to time as the result of improvements and new developments”.

Since the 1950s, when ISO/R 281 was drawn up, experience has shown that a theoretical difference between the case where the inner ring rotates in relation to the load and that where the outer ring rotates in relation to the load can be disregarded in practice. Thus, the rotation factor can be deleted from a standardized calculation. In addition, the evaluation of bearing life for reliabilities greater than 90 % has become of more frequent interest. Finally, in cases where material with properties deviating from those of conventional bearing steel is used and/or where the lubrication is not quite adequate, it has been found justified to adjust the rating life.

In this International Standard, the developments indicated above have been considered.

Part I, Calculation methods, contains the body of this International Standard, whilst Part II, Explanatory notes, gives supplementary background information regarding the derivation of formulae and factors given in Part I.

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Rolling bearings — Dynamic load ratings and rating life — Part I : Calculation methods

0 INTRODUCTION

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. Other methods are therefore required to establish this suitability.

Life, as defined in sub-clause 2.1, represents the period of unimpaired performance of a rolling bearing when the bearing is properly mounted, adequately lubricated, protected from foreign matter and not otherwise subjected to extreme operating conditions. A reliable life calculation is therefore considered to be a suitable and advantageous substitute for testing.

The purpose of this International Standard is to provide the required basis for this life calculation.

1 SCOPE AND FIELD OF APPLICATION

This International Standard sets out methods of calculating the basic dynamic load rating and rating life of rolling bearings within the size ranges shown in the relevant ISO publications, manufactured from 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 adjusted rating life to take into account various reliabilities, materials and operating conditions.

The present state of the art does not permit the inclusion in this International Standard of specifications such as, for example, that of the characteristics of good quality, hardened steel (analysis, inclusions, structure, hardness, etc.), or the inclusion of specific values of life adjustment factors for material and operating conditions. Revisions of this International Standard will therefore be required from time to time as the result of new developments or in the light of new information concerning specific bearing types.

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.

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 DEFINITIONS

2.1 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.

2.2 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.

2.3 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.

2.4 basic dynamic radial load rating : That constant stationary radial load which a rolling bearing can 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