TECHNICAL REPORT

ISO/TR 1281-1

Second edition
2021-05

Rolling bearings — Explanatory notes on ISO 281 —

Part 1: Basic dynamic load rating and basic rating life

Roulements — Notes explicatives sur l'ISO 281 —

Partie 1: Charges dynamiques de base et durée nominale de base

Reference number
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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.

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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of 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 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*.

This second edition cancels and replaces the Technical Corrigendum 1 (ISO/TR 1281-1:2008/Cor 1:2009) and the first edition (ISO/TR 1281-1:2008), which has been technically revised.

The main changes compared to the previous edition are as follows:

— The old Clause 7 "Life adjustment factor for reliability" of ISO/TR 1281-1:2008 has been deleted, this subject is covered in ISO/TR 1281-2 (see ISO/TR 1281-1:2008/Cor 1:2009).

— The derivation of the old Formulae (29) and (46) [Formulae (28) and (45) in this edition] has been corrected.

— Typing errors have been corrected in Formulae (30) and (31) and in the derivation of the factor Y_3.

A list of all parts in the ISO/TR 1281 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

ISO/R281:1962

A first discussion on an international level of the question of standardizing calculation methods for load ratings of rolling bearings took place at the 1934 conference of the International Federation of the National Standardizing Associations (ISA). When ISA held its last conference in 1939, no progress had been made. However, in its 1945 report on the state of rolling bearing standardization, the ISA 4 Secretariat included proposals for definition of concepts fundamental to load rating and life calculation standards. The definitions it contained are in essence those given in ISO 281:2007 for the concepts "life" and "basic dynamic load rating" (now divided into "basic dynamic radial load rating" and "basic dynamic axial load rating").

In 1946, on the initiative of the Anti-Friction Bearing Manufacturers Association (AFBMA), New York, discussions of load rating and life calculation standards started between industries in the USA and Sweden. Chiefly on the basis of the results appearing in Reference [5], an AFBMA standard, *Method of evaluating load ratings of annular ball bearings*[3], was worked out and published in 1949. On the same basis, the member body for Sweden presented, in February 1950, a first proposal to ISO, "Load rating of ball bearings".

In view of the results of both further research and a modification to the AFBMA standard in 1950, as well as interest in roller bearing rating standards, in 1951, the member body for Sweden submitted a modified proposal for rating of ball bearings as well as a proposal for rating of roller bearings.

Load rating and life calculation methods were then studied. Reference [6] was then of considerable use, serving as a major basis for the sections regarding roller bearing rating.

ISO 281-1:1977

In 1964, in view of the development of improved bearing steels, the time had come to review ISO/R281 and submitted a proposal

In 1969, on the other hand, TC 4 followed a suggestion by the member body for Japan and reconstituted its WG 3, giving it the task of revising ISO/R281. The AFBMA load rating working group had at this time started revision work.

The major part of ISO 281-1:1977 constituted a re-publication of ISO/R281, the substance of which had been only very slightly modified. However, based mainly on American investigations during the 1960s, a new clause was added, dealing with adjustment of rating life for reliability other than 90 % and for material and operating conditions.

Furthermore, supplementary background information regarding the derivation of mathematical expressions and factors given in ISO 281-1:1977 was published as ISO/TR 8646:1985.

ISO 281:1990

ISO 281:1990 was published as "First edition" and entitled "Dynamic load ratings and rating life". It is referred to as the "technical revision" of ISO 281-1:1977. The new rating factor b_m for "contemporary, normally used material and manufacturing quality, the value of which varies with bearing type and design" was the introduction as a co-value to the basic dynamic load ratings.

ISO 281:2007 (second edition)

Since the publication of ISO 281:1990 additional knowledge regarding the influence on bearing life of contamination, lubrication, internal stresses from mounting, stresses from hardening, fatigue load limit of the material, has been gained. In ISO 281:1990/Amd.2:2000, a general method was presented to consider such influences in the calculation of a modified rating life of a bearing. The said Amendment was incorporated into the second edition, which also provides a practical method to consider the influence on bearing life of lubrication conditions, contaminated lubricant and fatigue load of bearing

material. The life modification factors for reliability, a_1, have been slightly adjusted and extended to 99,95 % reliability.

Rolling bearings — Explanatory notes on ISO 281 —

Part 1:
Basic dynamic load rating and basic rating life

1 Scope

This document specifies supplementary background information regarding the derivation of mathematical expressions and factors given in ISO 281:2007.

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 281:2007, *Rolling bearings — Dynamic load ratings and rating life*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 281:2007 apply.

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

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

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

4 Symbols

A	constant of proportionality
A_1	constant of proportionality determined experimentally
B_1	constant of proportionality determined experimentally
C_1	basic dynamic radial load rating of a rotating ring
C_2	basic dynamic radial load rating of a stationary ring
C_a	basic dynamic axial load rating for thrust ball or roller bearing
C_a1	basic dynamic axial load rating of the rotating ring of an entire thrust ball or roller bearing
C_a2	basic dynamic axial load rating of the stationary ring of an entire thrust ball or roller bearing
$C_{\mathrm{a}k}$	basic dynamic axial load rating as a row k of an entire thrust ball or roller bearing
$C_{\mathrm{a1}k}$	basic dynamic axial load rating as a row k of the rotating ring of thrust ball or roller bearing
$C_{\mathrm{a2}k}$	basic dynamic axial load rating as a row k of the stationary ring of thrust ball or roller bearing