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BSI Standards Publication

Plain bearings — Hydrodynamic plain journal bearings under steady-state conditions

Part 1: Calculation of multi-lobed and tilting pad journal bearings

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National foreword

This Published Document is the UK implementation of ISO/TS 31657-1:2020.

The UK participation in its preparation was entrusted to Technical Committee MCE/12, Plain bearings.

A list of organizations represented on this committee can be obtained on request to its committee manager.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Foreword

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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).

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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 123, *Plain bearings*, Subcommittee SC 8, *Calculation methods for plain bearings and their applications*.

A list of all parts in the ISO/TS 31657 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

The aim of this document is the operationally-safe design of plain journal bearings for medium or high journal circumferential velocities, U_J, up to approximately 90 m/s by applying a calculation method for oil-lubricated hydrodynamic plain bearings with complete separation of journal and bearing sliding surfaces by a lubricating film.

For low circumferential velocities up to approximately 30 m/s usually circular cylindrical bearings are applied. For these bearings a similar calculation method is given in ISO 7902-1, ISO 7902-2 and ISO 7902-3.

Based on practical experience the calculation procedure is usable for application cases where specific bearing load times circumferential speed, $\overline{p} \cdot U_J$, does not exceed approximately 200 MPa·m/s.

This document discusses multi-lobed journal bearings with two, three and four equal, symmetrical sliding surfaces, which are separated by laterally-closed lubrication pockets, and symmetrically-loaded tilting-pad journal bearings with four and five pads. Here, the curvature radii, R_B, of the sliding surfaces are usually chosen larger than half the bearing diameter, D, so that an increased bearing clearance results at the pad ends.

The calculation method described here can also be used for other gap forms, for example asymmetrical multi-lobed journal bearings like offset-halves bearings, pressure-dam bearings or other tilting-pad journal bearing designs, if the numerical solutions of the basic formulas are available for these designs.

Plain bearings — Hydrodynamic plain journal bearings under steady-state conditions —

Part 1: Calculation of multi-lobed and tilting pad journal bearings

1 Scope

This document specifies the general principles, assumptions and preconditions for the calculation of multi-lobed and tilting-pad journal bearings by means of an easy-to-use calculation procedure based on numerous simplifying assumptions. For a reliable evaluation of the results of this calculation method, it is indispensable to consider the physical implications of these assumptions as well as practical experiences for instance from temperature measurements carried out on real machinery under typical operating conditions. Applied in this sense, this document presents a simple way to predict the approximate performance of plain journal bearings for those unable to access more complex and accurate calculation techniques.

The calculation method serves for the design and optimisation of plain bearings, for example in turbines, compressors, generators, electric motors, gears and pumps. It is restricted to steady-state operation, i.e. in continuous operating states the load according to size and direction and the angular velocity of the rotor are constant.

Unsteady operating states are not recorded. The stiffness and damping coefficients of the plain journal bearings required for the linear vibration and stability investigations are indicated in ISO/TS 31657-2 and ISO/TS 31657-3.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

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 and units

Table 1 contains the symbols used in the ISO 31657 series.

Table 1 — Symbols and units

Symbol	Description	Unit
B	Bearing width	m
B^*	Relative bearing width, width ratio as given by: $B^* = \frac{B}{D}$	1