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

**Part 2:
Functions for calculation of multi-
lobed journal bearings**

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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).

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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.

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

Part 2:

Functions for calculation of multi-lobed journal bearings

1 Scope

This document specifies the characteristic values for selected two-, three- and four-lobe bearings.

The functions plotted and listed in table form below are required for the operationally safe design of hydrodynamic multi-lobed journal bearings according to ISO/TS 31657-1. They are based on the presumptions and boundary conditions indicated there and only apply to stationary operating states. The symbols used are explained in ISO/TS 31657-1; calculation examples are also included there.

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 Functions for calculation of multi-lobed journal bearings

4.1 General

The characteristic values for two-, three- and four-lobe bearings with relative lubrication pocket widths of $b_p^* = 0,8$ are shown in table form below. The characteristic values were calculated for the geometrical parameters summarised in [Figure 1](#) (angular spans of segment sliding surface, Ω , angular coordinates of lubricant pocket centrelines, $\varphi_{p,1}$, gap ratios, $h_{0,max}^*$, bearing width ratios B^*) in the operating range $0,02 \leq h_{min}^* \leq 1$. The profile factors, K_p , associated with the indicated gap ratios, $h_{0,max}^*$, can be calculated for these bearing types as follows:

$$K_p = h_{0,max}^* \quad \text{for } Z = 2$$

$$K_p = 2 \cdot h_{0,max}^* - 1 \quad \text{for } Z = 3$$

$$K_P = \frac{h_{0,\max}^* - \frac{1}{\sqrt{2}}}{1 - \frac{1}{\sqrt{2}}} \quad \text{for } Z = 4$$

The following (dimensionless) characteristic values are indicated in [Tables 1](#) to [43](#):

a) Static characteristic values

Sommerfeld number:

$$So = \frac{F \cdot \psi_{\text{eff}}^2}{B \cdot D \cdot \eta_{\text{eff}} \cdot \omega}$$

Relative eccentricity:

$$\varepsilon = \frac{e}{C_{R,\text{eff}}}$$

Attitude angle, β , in °.

Product of maximum lubricant film pressure parameter and Sommerfeld number:

$$p_{\max}^* \cdot So = \frac{p_{\max} \cdot \psi_{\text{eff}}^2}{\eta_{\text{eff}} \cdot \omega}$$

Minimum relative lubricant film thickness:

$$h_{\min}^* = \frac{h_{\min}}{C_{R,\text{eff}}}$$

Friction force parameter:

$$F_f^* = \frac{f}{\psi_{\text{eff}}} \cdot So$$

Lubricant flow rate parameter due to hydrodynamic pressure build-up:

$$Q_3^* = \frac{Q_3}{Q_0}$$

Lubricant flow rate parameter due to supply pressure:

$$Q_p^* = \frac{Q_p}{P_{\text{en}}^* \cdot Q_0}$$

Lubricant flow rate parameter at the exit of the lubrication gap:

$$Q_2^* = \frac{Q_2}{Q_0}$$

Non-dimensional difference between maximum lubricant temperature and lubricant temperature in the lubricant pockets:

$$\Delta T_{\max}^* = \frac{\rho \cdot c_p \cdot \psi_{\text{eff}}}{\bar{p} \cdot f} \cdot \Delta T_{\max}$$

b) Dynamic characteristic values

Non-dimensional lubricant film stiffness coefficients:

$$c_{i,k}^* = \frac{\psi_{\text{eff}}^3}{2 \cdot B \cdot \eta_{\text{eff}} \cdot \omega} \cdot c_{i,k} \quad (i, k = 1, 2)$$

Non-dimensional lubricant film damping coefficients:

$$d_{i,k}^* = \frac{\psi_{\text{eff}}^3}{2 \cdot B \cdot \eta_{\text{eff}} \cdot \omega} \cdot \omega \cdot d_{i,k} \quad (i, k = 1, 2)$$

For some selected four-lobe bearings ($\Omega = 70^\circ$, $\varphi_{p,1} = 315^\circ$), these characteristic values are shown graphically as a function of the Sommerfeld number So , the gap ratio $h_{0,\max}^*$ and the bearing width ratio B^* in [Annex A](#), [Figures A.1](#) to [A.16](#).

Z	$\Omega[^\circ]$	$\varphi_{p,1}[^\circ]$	$h_{0,\max}^*$	B^*	Load case
2	150	180	3, 5	0,75	
		240	3, 5	0,75	
		270	1, 3, 5	0,5, 0,75, 1	
		300	3, 5	0,75	
3	100	240	3, 5	0,75	
		300	1, 3, 5	0,5, 0,75, 1	
4	70	270	3, 5	0,75	
		315	1, 2, 3, 4, 5	0,5, 0,75, 1	

Figure 1 — Geometrical parameters of selected multi-lobed journal bearings