SLOVENSKI STANDARD
SIST ISO 12130-3:2002

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Drsni leģaji - Hidrodinamiļ ni drsni samoprilagodljivi aksialni segmentni leģaji pri stacionarnih pogojih obratovanja - 3. del: Priporoļ ene vrednosti za preraļ un samoprilagodljivih aksialnih segmentnih leģajev

Plain bearings -- Hydrodynamic plain tilting pad thrust bearings under steady-state conditions -- Part 3: Guide values for the calculation of tilting pad thrust bearings

Paliers lisses -- Butées hydrodynamiques à patins oscillants fonctionnant en régime stationnaire -- Partie 3: Paramètres opérationnels admissibles pour le calcul des butées à patins oscillants

Ta slovenski standard je istoveten z: **ISO 12130-3:2001**

ICS:

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INTERNATIONAL STANDARD

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Plain bearings — Hydrodynamic plain tilting pad thrust bearings under steady-state conditions —

Part 3: Guide values for the calculation of tilting pad thrust bearings

Paliers lisses — Butées hydrodynamiques à patins oscillants fonctionnant en régime stationnaire —

Partie 3: Paramètres opérationnels admissibles pour le calcul des butées à patins oscillants

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.ch
Web www.iso.ch

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 12130 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 12130-3 was prepared by Technical Committee ISO/TC 123, *Plain bearings*, Subcommittee SC 4, *Methods of calculation of plain bearings*.

ISO 12130 consists of the following parts, under the general title *Plain bearings — Hydrodynamic plain tilting pad thrust bearings under steady-state conditions*:

— *Part 1: Calculation of tilting pad thrust bearings*

— *Part 2: Functions for calculation of tilting pad thrust bearings*

— *Part 3: Guide values for the calculation of tilting pad thrust bearings*

Introduction

In order to achieve that tilting pad thrust bearings calculated in accordance with ISO 12130-1 are sufficiently reliable in operation, it is necessary that the calculated operational parameters h_{min}, T_B or T_2 and $\overline{p}$ do not fall below or exceed the guide values h_{lim}, T_{lim} and $\overline{p}_{lim}$.

For limiting cases at high specific loads and/or high rotational frequencies, more accurate calculations are necessary taking into consideration thermal, elastic, hydrodynamic and/or turbulence effects.

The guide values represent limiting values in the tribological system plain bearing unit which are dependent on geometry and technology. These are empirical values which give still sufficient reliability in operation even when subjected to slight disturbing influence as shown in clause 4 of ISO 12130-1:2001.

Plain bearings — Hydrodynamic plain tilting pad thrust bearings under steady-state conditions —

Part 3: Guide values for the calculation of tilting pad thrust bearings

1 Scope

This part of ISO 12130 specifies guide values for the calculation of tilting pad thrust bearings as described in ISO 12130-1.

The empirical values given can be modified for specific fields of application.

This part of ISO 12130 is not applicable to heavily loaded tilting pad thrust bearings.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 12130. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 12130 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 4381, *Plain bearings — Lead and tin casting alloys for multilayer plain bearings*

ISO 4382-1, *Plain bearings — Copper alloys — Part 1: Cast copper alloys for solid and multilayer thick-walled plain bearings*

ISO 4382-2, *Plain bearings — Copper alloys — Part 2: Wrought copper alloys for solid plain bearings*

ISO 4383, *Plain bearings — Multilayer materials for thin-walled plain bearings*

ISO 12130-1:2001, *Plain bearings — Hydrodynamic plain tilting pad thrust bearings under steady-state conditions — Part 1: Calculation of tilting pad thrust bearings*

3 Guide values to avoid damage caused by wear

Explanation of the symbols and examples of calculation are to be found in ISO 12130-1.

To achieve minimum wear and low susceptance to failure it is aimed at full lubrication of the plain bearing unit by taking into account the minimum permissible lubricant film thickness h_{lim}. The lubricant should be free from dirt as this may result in increasing wear, scoring and local overheating which would impair the correct functioning of the plain bearing. If necessary, the lubricant shall be filtered.

The minimum lubricant film thickness $h_{lim,tr}$ as a characteristic value for the transition into mixed lubrication (see ISO 12130-1) can be determined according to [1] using the following empirical equation:

$$h_{lim,tr} = \sqrt{\frac{D \times Rz}{12\,000}} \tag{1}$$

This simple equation takes into account that, in general, machining tolerances increase with increasing size of the work piece.

However, as in this case the machining method and the actual conditions of the machine tools have a great influence, the value $h_{lim,tr}$ calculated on this basis is of limited information only.

Faulty manufacturing of shafts, flanges or thrust collars and the exceeding of permissible tolerances very quickly results in failure of the plain thrust bearings. Further, it is of importance how long a machine is operated under mixed lubrication during starting and stopping.

For higher sliding velocities it is suitable to also increase the minimum permissible lubricant film thicknesses for standard operation so that e.g. during stopping, the mixed lubrication range is not reached too quickly.

Guide values for the minimum permissible lubricant film thickness h_{lim} may be calculated as follows:

$$h_{lim} = C\sqrt{U \times D \times \frac{F_{st}}{F}} \tag{2}$$

where

$C = 0{,}4 \times 10^{-5}$ up to $2{,}9 \times 10^{-5}$ and the F_{st}/F, ratio between the load-carrying capacity under conditions of standstill F_{st} and the bearing force F at nominal rotational frequency.

When equation (2) is used it is to be observed that always:

$$h_{lim} > h_{lim,tr} \tag{3}$$

It is recommended that $h_{lim} \geqslant 1{,}25\ h_{lim,tr}$

Empirical values for h_{lim} are given in Tables 1 and 2.

For $F_{st}/F = 0$, the values of the first column in Tables 1 and 2 are valid independent of the sliding velocity.

Table 1 — Guide values for the minimum permissible lubricant film thickness h_{lim} in µm for F_{st}/F = 1 calculated where $C = 1 \times 10^{-5}$

Mean sliding diameter D (thrust ring diameter) mm	Mean sliding velocity of thrust collar U m/s					
	$1 \leqslant U \leqslant 2{,}4$	$2{,}4 < U \leqslant 4$	$4 < U \leqslant 6{,}3$	$6{,}3 < U \leqslant 10$	$10 < U \leqslant 24$	$24 < U \leqslant 40$
	Minimum permissible lubricant film thickness h_{lim} µ					
$24 \leqslant D \leqslant 63$	4	4	4,8	6	8,5	12
$63 < D \leqslant 160$	6,5	6,5	7,5	8,5	14	19
$160 < D \leqslant 400$	10	10	12	15	22	30
$400 < D \leqslant 1\,000$	16	16	19	24	35	48
$1\,000 < D \leqslant 2\,500$	26	26	30	38	55	75

Table 2 — Guide values for the minimum permissible lubricant film thickness h_{lim} in µm for F_{st}/F = 0,25 calculated where $C = 1 \times 10^{-5}$

Mean sliding diameter D (thrust ring diameter) mm	Mean sliding velocity of thrust collar U m/s					
	$1 \leqslant U \leqslant 2{,}4$	$2{,}4 < U \leqslant 4$	$4 < U \leqslant 6{,}3$	$6{,}3 < U \leqslant 10$	$10 < U \leqslant 24$	$24 < U \leqslant 40$
	Minimum permissible lubricant film thickness h_{lim} µ					
$24 \leqslant D \leqslant 63$	4	4	4	4	4,3	6
$63 < D \leqslant 160$	6,5	6,5	6,5	6,5	7	8,5
$160 < D \leqslant 400$	10	10	10	10	11	15
$400 < D \leqslant 1\,000$	16	16	16	16	17	24
$1\,000 < D \leqslant 2\,500$	26	26	26	26	27	37

4 Guide values to avoid mechanical overloading

The maximum permissible specific bearing load $\overline{p}_{lim}$ results from the requirement that deformation of the sliding surfaces shall neither lead to an impairment of the correct functioning nor to cracks. Besides the composition of the bearing material there is still a great number of other decisive influencing factors such as, e.g., the manufacturing process, the material structure, the thickness of the bearing material as well as the shape and type of the bearing backing. Irrespective of this, it shall be checked whether there is already full loading during starting. If the specific bearing load during starting $\overline{p} > 2{,}5$ N/mm^2 but $\leqslant 3$ N/mm^2, a hydrostatic arrangement shall be provided, if appropriate, otherwise wear on the sliding surfaces may occur. The data given in Table 3 are general empirical values for $\overline{p}_{lim}$.