TECHNICAL REPORT

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Plain bearings — Lubrication characteristics of crosshead pin bearings for low-speed marine diesel engines

Paliers lisses — Caractéristiques de lubrification des paliers de crosse pour moteurs diesels marins à vitesse faible

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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.org
Web www.iso.org

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Foreword

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The committee responsible for this document is ISO/TC 123, *Plain bearings*, Subcommittee SC 7, *Special types of plain bearings*.

Introduction

For crosshead pin bearings, with which a shaft oscillates when a load is applied mainly in a downward direction, it is difficult to generate an appropriate lubricating film; therefore, they are subject to unfavourable lubricating conditions. For better lubrication of crosshead pin bearings, which have a high rate of damage, two types of bearing structures are mainly used as oil supply methods for sliding surfaces at present. The characteristics of those bearings are compared and the concept of design approaches is standardized.

Plain bearings — Lubrication characteristics of crosshead pin bearings for low-speed marine diesel engines

1 Scope

This Technical Report specifies lubrication characteristics of grooves and pockets on crosshead pin bearings for low-speed marine diesel engines.

It is applicable to the design of axial oil groove and pocket types as an oil supply method.

2 Crosshead pin bearing and its symbols

The crosshead pin bearing and changes in specific load and angular velocity during one cycle are schematically illustrated in Figures 1 and 2. Table 1 shows the symbols and their descriptions.

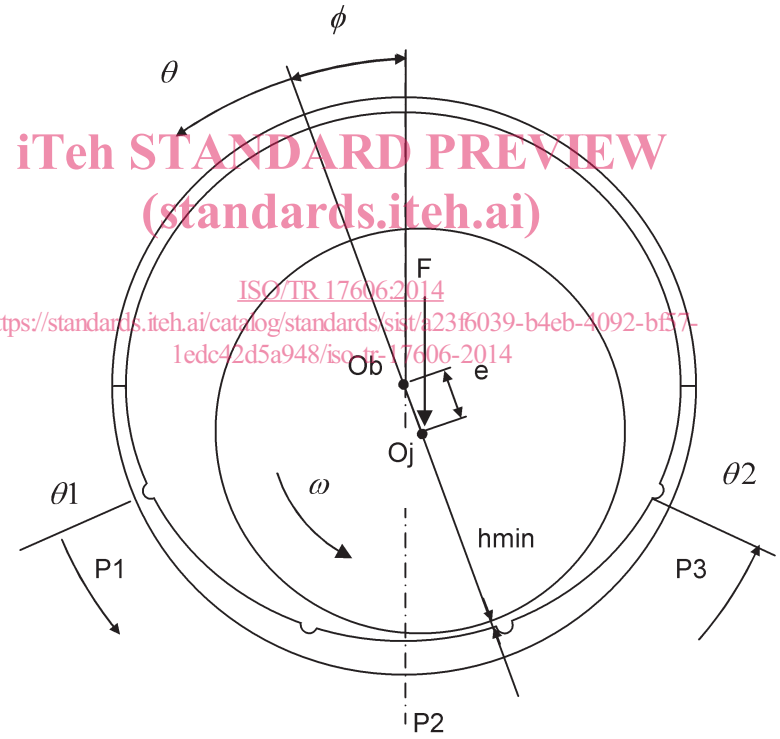

Figure 1 — Crosshead pin bearing

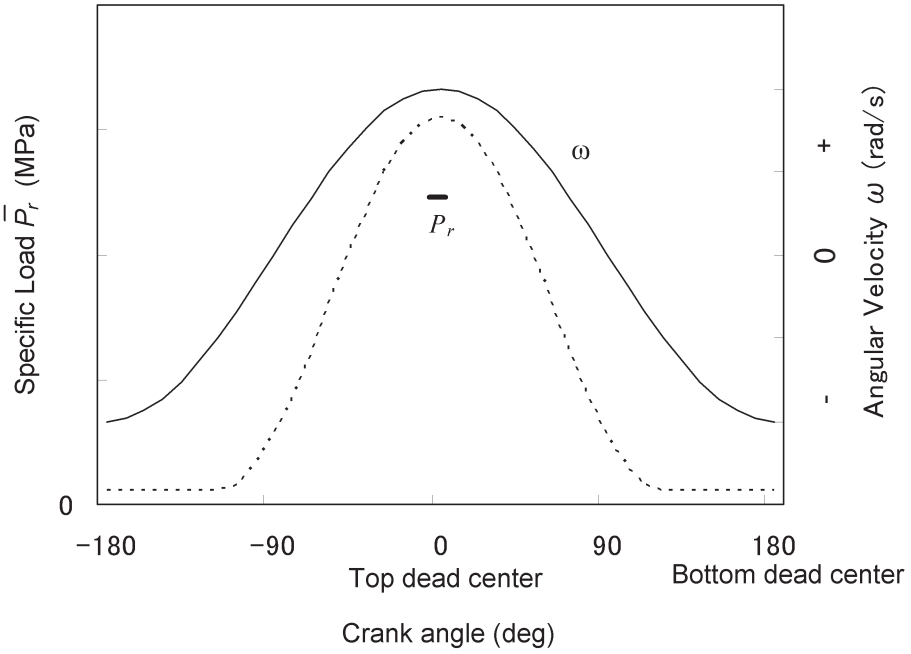

Figure 2 — Changes in specific load and angular velocity during one cycle

Table 1 — Symbols and their descriptions

Symbol	Description
e	eccentricity
hmin	minimum oil film thickness
l	subtended taper length
L	axial width
O_b	center of bearing
O_j	center of journal
p	oil film pressure
P1	pad 1
P2	pad 2
P3	pad 3
$\bar{P}_r$	specific load
r	shaft radius
F	bearing load
α	circumferential pitch angle
β	circumferential width angle
γ	taper depth
φ	oscillation angle
ϕ	attitude angle
θ	circumferential angular coordinate
$\theta 2 - \theta 1$	effective angular extent of bearing arc
ω	angular velocity

3 Oil supply method on bearing sliding surfaces

There are two oil supply methods. One is for bearings with a few (normally four) axial grooves. Oil is supplied to the sliding surface at normal pressure through these oil grooves. The other is for bearings with two oil pockets symmetrically located relative to the central part of each bearing. Oil is supplied to the oil pockets at high pressure to provide a hydrostatic bearing mechanism (see Figure 3).

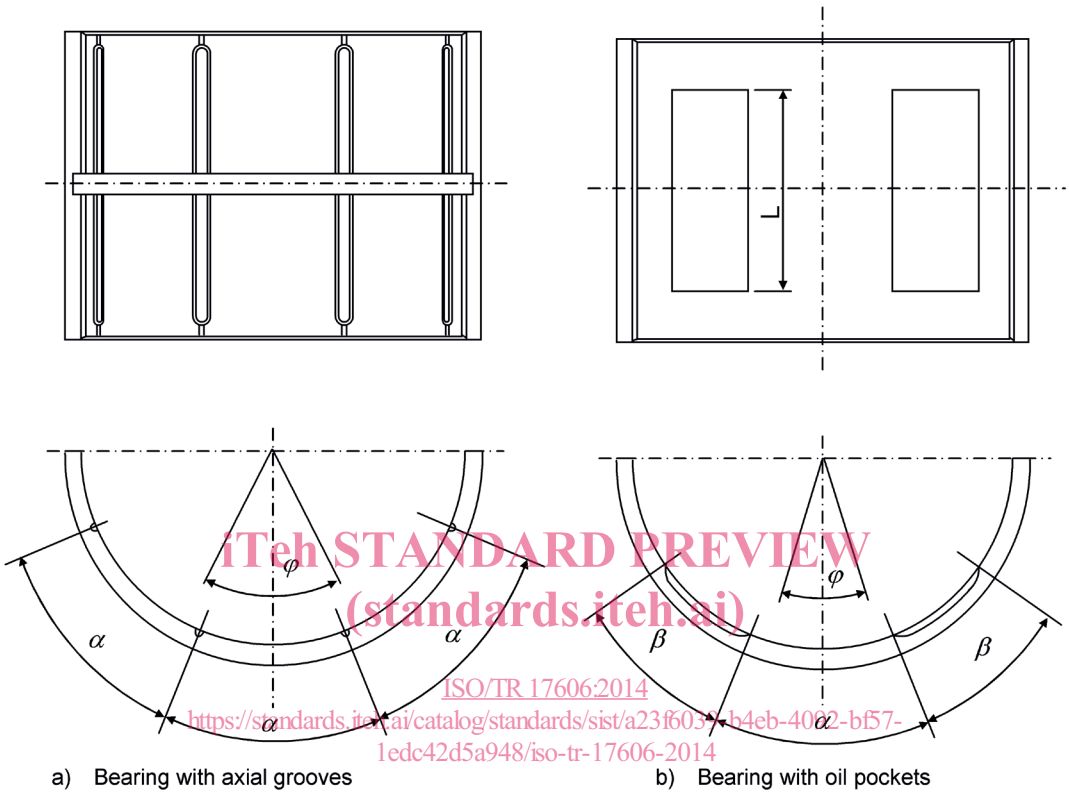

Figure 3 — Bearings with axial grooves and oil pockets

4 Shape of a bearing

4.1 Bearing inside diameter, bearing width, height, circumferential groove, and an upper bearing

The diameter of a crosshead pin is set by consideration of strength design taking into account such as cylinder bore diameter and explosion pressure. The inside diameter of the bearing is based on the diameter of its crosshead pin. The bearing width is set within the allowable specific pressure range for its bearing material in consideration of the durability and strength of the material. Normally, single wide (integral structure) bearings are commonly used with respect to each cylinder. Some bearings may be axially divided into two parts for the reason of production of their bearing materials. The height of the bearing should be set to ensure adequate interference fit. The height measurement method is the same as for smaller sized half-bearings. The crosshead housing can be checked for deformation due to the tightening of the bearing by conducting an assembly test using a housing (it might affect bearing clearance). In the case of a bearing with more than one axial groove, it may be provided with a circumferential groove around (part of) the entire circumference. The upper bearing on the unloaded side is provided with a relatively wide opening to allow the crosshead pin, which is connected to a piston rod, and the crosshead pin bearing to oscillate relative to each other.