

INTERNATIONAL
STANDARD

ISO
22423

First edition
2019-01

**Foil bearings — Performance testing
of foil thrust bearings — Testing of
static load capacity, bearing torque,
friction coefficient and lifetime**



Reference number
ISO 22423:2019(E)

© ISO 2019



COPYRIGHT PROTECTED DOCUMENT

© ISO 2019

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Symbols	2
4.1 Basic characters — Roman alphabet.....	2
4.2 Basic characters — Greek alphabet.....	3
4.3 Additional signs — Subscripts.....	3
5 Purpose of test	3
6 Test conditions	3
6.1 General.....	3
6.2 Design of test apparatus.....	4
6.3 Installation of sensors.....	4
6.4 Test specimens.....	4
7 Test methods	5
7.1 Principle.....	5
7.2 Start–stop test cycle and evaluation of the take-off speed.....	5
7.3 Calculation of bearing torque and load.....	7
7.4 Determination of static load capacity.....	7
7.5 Evaluation of static load capacity per unit area.....	8
8 Friction coefficient	8
9 Durability test and lifetime	8
9.1 Test procedure.....	8
9.2 Determination of lifetime.....	9
10 Test report	9
Annex A (informative) Configuration of a typical foil thrust bearing	10
Annex B (informative) Test report	12
Bibliography	13

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 123, *Plain bearings*, Subcommittee SC 7, *Special types of plain bearings*.

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

Design improvements commonly required for rotating machines such as turbines, generators, compressors and pumps include increases in speed and decreases in size. Foil bearings in turbomachinery operate by generating a self-acting air (or gas) film between surfaces in relative motion. A gap between a rotating shaft or runner and a foil surface compresses a gaseous lubricant to an elevated pressure, separating the relatively moving surfaces and providing a load-carrying capacity. The use of the surrounding air (or gas) as the bearing lubricant eliminates the need for an auxiliary lubrication system to deliver conventional oil lubricants. This permits drastic reductions in the weight, complexity and maintenance costs of foil bearing-supported turbomachines, in comparison to their rolling bearing-supported counterparts. It also permits higher shaft speeds by removing the $n \times d_m$ speed limits (where d_m is the mean diameter of bearing and n is the rotation rate) on rolling bearings.

Foil bearings — Performance testing of foil thrust bearings — Testing of static load capacity, bearing torque, friction coefficient and lifetime

1 Scope

This document specifies the method for comparing performance evaluation results for a foil thrust bearing that supports load with aerodynamic force generated by the rotation of a driving shaft and lubricates using air, not lubricating oil. The test procedure explained in this document measures and evaluates the static load capacity, bearing torque, friction coefficient and lifetime of the foil thrust bearing and compares the test results to those for different test conditions. The measured static load capacity can be varied depending on the capabilities of the test device used.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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/>

3.1

thrust runner runner

circular disc connected to the rotating shaft and facing the surface of the top foil

Note 1 to entry: The surfaces of the thrust runner should be machined smoothly enough to form the air film between the runner and the top foil.

3.2

take-off

stage aimed to secure the distance between the *thrust runner* (3.1) and the top foil by developing an aerodynamic pressure between them

3.3

clearance

shortest distance between the *thrust runner* (3.1) and the top foil

3.4

bearing torque

torque value developed by rotational friction between the *thrust runner* (3.1) and the top foil

Note 1 to entry: The measurement of the bearing torque is as described in 7.3.

3.5

load

load capacity

weight that can be delivered by a bearing under steady-state conditions