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**Plain bearings — Metallic multilayer  
plain bearings —**

Part 2:

**Destructive testing of bond for bearing  
metal layer thicknesses greater than  
or equal to 2 mm**

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*Paliers lisses — Paliers lisses métalliques multicouches —*

*Partie 2: Détermination, par essai destructif, de l'adhérence du  
matériau antifriction d'épaisseur supérieure ou égale à 2 mm*

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Published in Switzerland

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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](http://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](http://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](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 123, *Plain bearings*, Subcommittee SC 2, *Materials and lubricants, their properties, characteristics, test methods and testing conditions*.

This third edition cancels and replaces the second edition (ISO 4386-2:2012), of which it constitutes a minor revision. The changes compared to the previous edition are as follows:

- Adjustment to the ISO Directives, including the implementation of [Clause 3 Terms and definitions](#).

A list of all parts in the ISO 4386 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](http://www.iso.org/members.html).

## Introduction

Long years of experience with bond tests led to an adaptation of this document. The test apparatus has been modified to reduce the negative local bending stress influence on the specimen. The geometry of the test specimen has been modified to avoid negative influence due to tolerances. A description of the specimen machining sequence has been added to get a more uniform specimen. A subclause on the application for quality control has been added.

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# Plain bearings — Metallic multilayer plain bearings —

## Part 2:

# Destructive testing of bond for bearing metal layer thicknesses greater than or equal to 2 mm

## 1 Scope

This document specifies a tensile test method for determination of the bond strength between the bearing metal and the backing. The test can be applied to multilayer plain bearings with bearing metals based on lead, tin, copper or aluminium. For tested layer thicknesses  $\geq 2$  mm, a raw lining thickness of a minimum additional 1 mm is necessary.

The backings are from steel, cast steel or copper alloys. The bond strength test does not apply to bearings with cast iron backing.

The test applies to all thrust bearings and to journal bearings with an inner diameter of backing  $\geq 90$  mm.

The test can be used for comparative investigations into the influence on the bond strength of various processes and types of material. In addition, the test is suitable for production control and for process qualification of bearing production.

For non-destructive ultrasonic testing of the bond between bearing metal and backing for bearing metal layer thicknesses  $\geq 2$  mm, see ISO 4386-1.

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## 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 Principle

During the tensile testing carried out vertically to the bond surface, the bond strength,  $R_{Ch}$ , in newtons per square millimetre, is the quotient of the maximum force,  $F_{max}$ , in newtons and the bond surface,  $A$ , in square millimetres, of the specimen (see Table 2), as given by Formula (1).

NOTE The subscript "Ch" refers to the test method proposed by Chalmers.

$$R_{Ch} = \frac{F_{max}}{A} \quad (1)$$

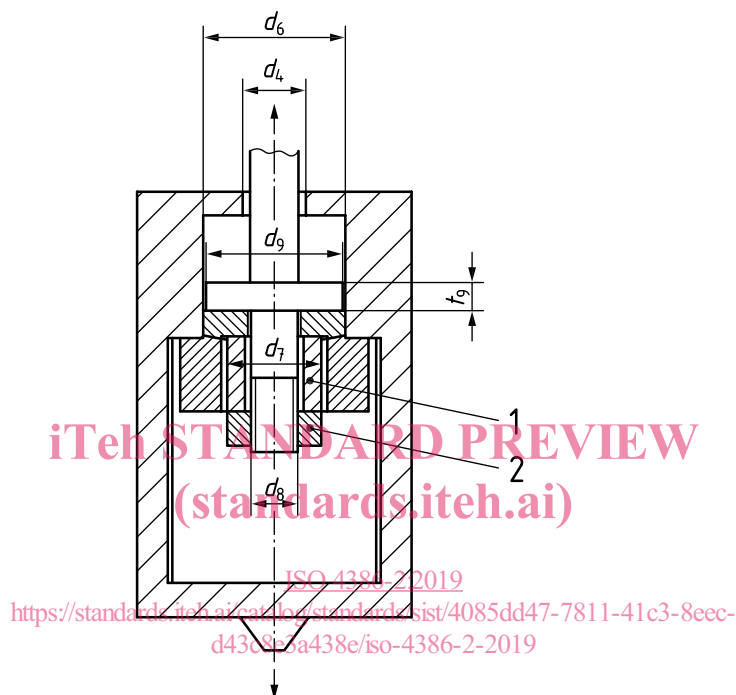
## 5 Test equipment

### 5.1 General

A calibrated tensile testing machine shall be used with apparatus in accordance with [Table 1](#).

By means of careful adjustment of the apparatus, it shall be ensured that the force is acting vertically to the bond surface in order to avoid incorrect measurements.

### 5.2 Testing apparatus



#### Key

- 1 distance tube
- 2 nut

**Figure 1 — Main dimensions of apparatus**

NOTE Details not indicated in this document are expected to be chosen accordingly.

**Table 1 — Dimensions and tolerances for test apparatus**

Dimensions in millimetres

Type of specimen	Apparatus geometry data					
	$d_4$	$d_6$	$d_7$	$d_8$	$d_9$	$t_9$
	$\begin{matrix} +0,1 \\ 0 \end{matrix}$	$\begin{matrix} +0,1 \\ 0 \end{matrix}$	$\begin{matrix} 0 \\ -0,1 \end{matrix}$	NA	NA	NA
T 100	8,1	19,8	15,9	M 8	19	4
T 200	12,1	29,1	23,9	M 12	28	4

NA: not applicable



## 6 Specimen

### 6.1 General

Tin casting alloys for multilayer plain bearings are specified in ISO 4381.

For selection of the type of specimen in the case of journal bearings, the inner diameter,  $d_1$ , of the bearing has to be considered.

Specimen T 100 is valid from the minimum diameter  $d_1 = 90$  mm up to  $d_1 = 200$  mm.

Specimen T 200 is valid for all diameters  $d_1 > 200$  mm.

For the thrust bearing specimens, T 100 and T 200 may be used. Whenever possible, T 200 should be preferred.

Both bearing metal faces shall be machined as a precondition for fixing the bearing metal layer on the test apparatus to avoid bending deformation of the bearing metal during test procedure. Use test apparatus in accordance with [Table 1](#).

Specimens shall be manufactured in accordance with [Table 2](#), [Figure 2](#) and [5.1](#).

**Table 2 — Dimensions and tolerances for specimens (see [Figure 2](#))**

Dimensions in millimetres

Type of specimen	Bond surface $A$ mm <sup>2</sup>	Inner diameter of the backing of journal bearing $d_1$	Specimen geometry data			
			$d_2$	$d_3$	$d_4$	$d_5$
T 100	100	90 - 200	h8 19,60	H8 16	+0,1 0 8,1	29
T 200	200	>200	28,85	24	12,1	38