

---

---

**Plain bearings — Thin-walled half  
bearings with or without flange —**  
Part 2:  
**Measurement of wall thickness and  
flange thickness**

STANDARDSISO.COM : Click to view the full PDF of ISO 3548-2:2020



STANDARDSISO.COM : Click to view the full PDF of ISO 3548-2:2020



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2020

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  
Email: [copyright@iso.org](mailto:copyright@iso.org)  
Website: [www.iso.org](http://www.iso.org)

Published in Switzerland

# Contents

|   | Page      |
|---|-----------|
| Foreword .....  | iv        |
| <b>1 Scope .....</b>  | <b>1</b>  |
| <b>2 Normative references .....</b>   | <b>1</b>  |
| <b>3 Terms and definition .....</b>   | <b>1</b>  |
| <b>4 Symbols and units .....</b>  | <b>2</b>  |
| <b>5 Purpose of checking .....</b>  | <b>2</b>  |
| <b>6 Checking methods .....</b>   | <b>3</b>  |
| 6.1 Measuring principle of wall thickness .....   | 3         |
| 6.2 Line measurement around the circumference .....                                     | 3         |
| 6.3 Line measurement in axial direction .....   | 4         |
| 6.4 Point measurement .....   | 5         |
| 6.5 Grading of bearings .....   | 7         |
| 6.6 Eccentric bore .....  | 7         |
| 6.7 Measuring principle for flange thickness .....                                      | 7         |
| 6.8 Measuring point for flange thickness .....  | 7         |
| <b>7 Requirements for measuring equipment and specimen for the contact method .....</b> | <b>8</b>  |
| 7.1 Tip-radius for measuring pin on the outside surface .....                           | 8         |
| 7.2 Tip-radius for measuring pin on the inside surface .....                            | 8         |
| 7.3 Measuring pin load .....  | 8         |
| 7.4 Set-up .....  | 8         |
| 7.5 Periodical control .....  | 8         |
| 7.6 Measurement failures on the inside and/or outside surface .....                     | 9         |
| <b>8 Checking of measuring equipment .....</b>  | <b>9</b>  |
| <b>Bibliography .....</b>   | <b>10</b> |

## 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 5, *Quality analysis and assurance*.

This second edition cancels and replaces the first edition (ISO 3548-2:2009), which has been technically revised. The main changes compared to the previous edition are as follows:

- the term “flange thickness” has been introduced in [Clause 3](#);
- [Table 1](#) has been updated;
- several figures have been revised;
- a new [Table 3](#) “Thin walled half bearings with flange — Distance to measuring position  $a_{ch}$ ” has been introduced.

A list of all parts in the ISO 3548 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).

# Plain bearings — Thin-walled half bearings with or without flange —

## Part 2: Measurement of wall thickness and flange thickness

### 1 Scope

This document specifies in accordance with ISO 12301 the checking of the wall-thickness of thin-walled half bearings with or without flange and describes the necessary checking methods and measuring equipment.

It applies to a maximum bearing diameter of 150 mm. It can be applied to a bigger diameter, provided that there is an agreement between the supplier and the user.

### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3548-1, *Plain bearings — Thin-walled half bearings with or without flange — Part 1: Tolerances, design features and methods of test*

### 3 Terms and definition

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <http://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

For the purposes of this document, the following definitions apply:

#### 3.1 wall thickness

$s_3$

radial distance between the opposing measuring points at the inner and outer cylindrical surfaces

Note 1 to entry: See [Figure 1](#).

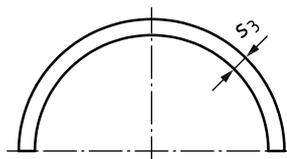


Figure 1 — Wall thickness,  $s_3$ , of a half bearing

**3.2  
measuring point**

agreed point established to facilitate agreement on checking

Note 1 to entry: The establishment of measuring points (lines) does not preclude the need to comply with dimensional specifications in other areas.

**3.3  
measuring line**

agreed line established to facilitate agreement on checking

Note 1 to entry: The establishment of measuring lines does not preclude the need to comply with dimensional specifications in other areas.

**3.4  
tolerance**

range between the upper specified limit and the lower specified limit

**3.5  
flange thickness**

axial distance between the opposing measuring points at the inside and the outside surface of flange

**4 Symbols and units**

For the purposes of this document, the symbols and units are those given in [Table 1](#).

**Table 1 — Symbols and units**

| Symbol      | Description  | Unit |
|-------------|--|------|
| $a_{ch}$    | distance to measuring position                                 | mm   |
| $a_9$       | minimum height of transition                                   | mm   |
| $a_{ch,fl}$ | radial distance to measuring position from flange outside edge | mm   |
| $B$         | width  | mm   |
| $B_{fl}$    | flange width   | mm   |
| $C_i$       | inner chamfer width  | mm   |
| $D_0$       | nominal outside diameter                                       | mm   |
| $e_B$       | eccentricity of bore centre to outside diameter centre         | mm   |
| $F_{pin}$   | measuring pin load   | N    |
| $H$         | distance to measuring position from bearing parting line       | mm   |
| $s_a$       | wall thickness at angle $\alpha$                               | mm   |
| $s_{fl}$    | flange thickness   | mm   |
| $s_3$       | wall thickness at crown  | mm   |
| $u$         | wall thickness reduction at angle $\alpha_2$                   | mm   |
| $x_1$       | centre point of nominal outside diameter                       | —    |
| $x_2$       | centre point of eccentric bore                                 | —    |
| $\alpha$    | angle to measuring position                                    | °    |
| $\alpha_2$  | angle to measuring position from parting line                  | °    |
| M1, M2      | measuring line   | —    |

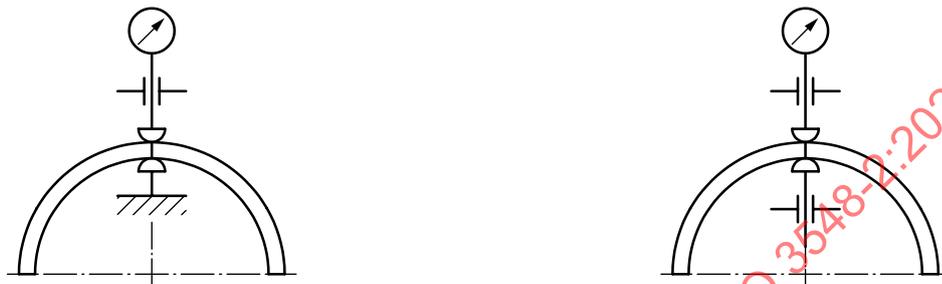
**5 Purpose of checking**

In order to ensure the required bearing clearance, and consequently, the operational efficiency of the plain bearing unit, keep to the wall thickness tolerances specified in ISO 3548-1.

## 6 Checking methods

### 6.1 Measuring principle of wall thickness

The gauging axis of the measuring device shall be in the radial direction and perpendicular to the outside surface of the test piece in order to find the minimum value of the wall thickness. The measured values may be recorded by a single measurement or by sum measurement, which are symbolically represented in [Figure 2](#).



a) Single wall thickness measurement by contact (mechanical/electronic gauge)

b) Sum wall thickness measurement by contact/non-contact (electronic/pneumatic gauge)

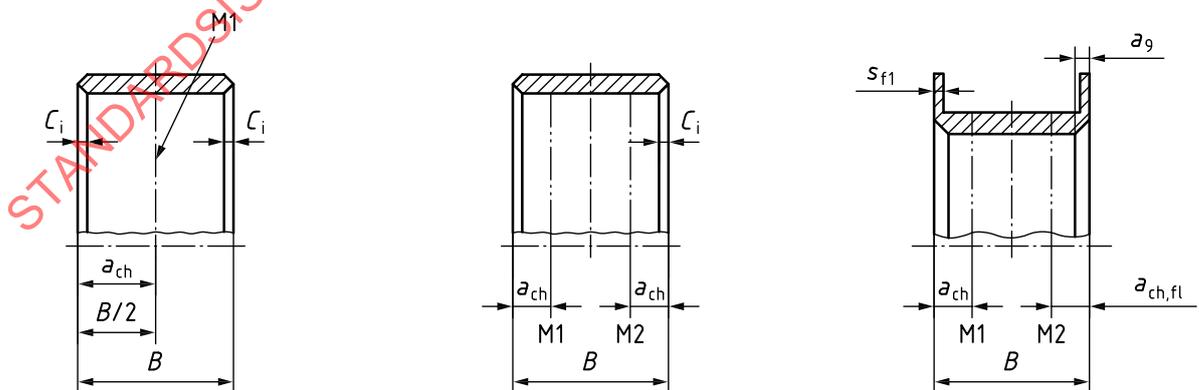
Figure 2 — Methods for recording the measured value

The presence of lubricating holes, oil pockets, oil grooves, markings or special chamfers may require deviation from the measuring lines and measuring points specified in the following and shall be agreed between the customer and the supplier.

Any wall thickness not conforming to the specified values due to the manufacturing process, because of deformation of the bearing backing in the area of marking or at non-load bearing places, shall be agreed between the customer and the supplier.

### 6.2 Line measurement around the circumference

Measurement of the wall thickness around the circumference shall be carried out at the measuring lines specified in [Figure 3](#) and [Tables 2](#) and [3](#).



a) Thin wall bearing without flange,  $B < 15$  mm

b) Thin wall bearing without flange  $B \geq 15$  mm

c) Thin wall bearing with flanges

**Key**

- $C_i$  inner chamfer width
- $a_{ch}$  distance to measuring position
- $a_{ch,fl}$  distance to measuring position for thin wall bearings with flanges
- M1,M2 measuring line

**Figure 3 — Position of measuring lines**

**Table 2 — Thin-walled half bearings without flange — Distance to measuring position,  $a_{ch}$**

| Width<br>$B$     | Distance to measuring position<br>$a_{ch}$ | Number of measuring lines M1, M2 |
|------------------|--|----------------------------------|
| $B \leq 15$      | $B/2 - C_i$                                | 1                                |
| $15 < B \leq 50$ | 4  | 2                                |
| $B > 50$         | 6  | 2                                |

**Table 3 — Thin-walled half bearings with flange — Distance to measuring position,  $a_{ch}$**

| Width<br>$B$        | Distance to measuring position<br>$a_{ch}$ | Number of measuring lines M1, M2 |
|---------------------|--|----------------------------------|
| $B < 15$            | $B/2$                                      | 1                                |
| $15 \leq B \leq 50$ | $C_i + s_{fl} + a_g + 4 \text{ mm}$        | 2 <sup>a</sup>                   |
| $50 < B \leq 90$    | $C_i + s_{fl} + a_g + 4 \text{ mm}$        | 2 <sup>a</sup>                   |
| $B > 90$            | $C_i + s_{fl} + a_g + 8 \text{ mm}$        | 2 <sup>b</sup>                   |

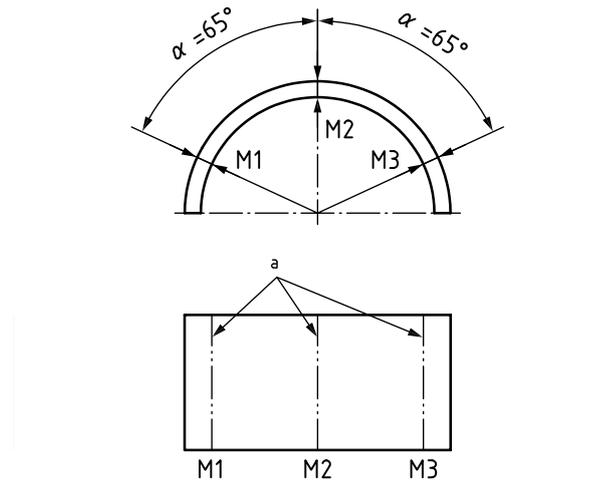
<sup>a</sup> Only valid for:  $C_i + s_{fl} + a_g + 4 \text{ mm} \leq B/2 - 2 \text{ mm}$ , otherwise only one measuring line shall be used.  
<sup>b</sup> Only valid for:  $C_i + s_{fl} + a_g + 8 \text{ mm} \leq B/2 - 2 \text{ mm}$ , otherwise only one measuring line shall be used

**6.3 Line measurement in axial direction**

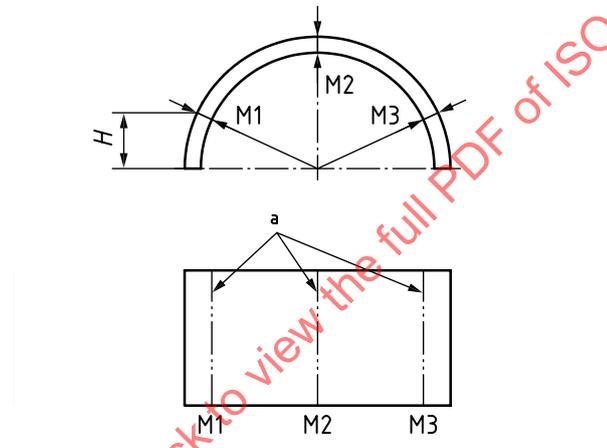
Measurement of the wall thickness in axial direction shall be carried out by using the definition of measuring lines specified in Figure 4 a) (Method A) or by using the definition of measuring lines specified in Figure 4 b) and Table 3 (Method B).

For Method B, the distance to the measuring position H shall not result into measurement within the crush relief area.

The position of the measuring lines for bearings with a nominal outside diameter greater than 150 mm is subject to agreement between the manufacturer and the customer.



a) Position of measuring lines — Method A



b) Position of measuring lines — Method B

a Measuring lines, M.

Figure 4 — Position of measuring lines

Table 4 — Distance to measuring position

| Nominal outside diameter<br>$D_0$ | Distance to measuring position<br>$H$ |
|-----------------------------------|---------------------------------------|
| $25 < D_0 \leq 40$                | $6 < H \leq 8$                        |
| $40 < D_0 \leq 90$                | $9 < H \leq 13$                       |
| $90 < D_0 \leq 120$               | $H = 13$                              |
| $120 < D_0 \leq 150$              | $H = 20$                              |

### 6.4 Point measurement

Point-by-point measurement of wall thickness shall be carried out by using the definition of measuring points specified in Figure 5 or Figure 6 a) (Method A) or Figure 6 b) and Table 3 (Method B) for widths less than or equal to 90 mm. In the case where  $B$  is greater than 90 mm, the selection of the measurement method (Method A or Method B) shall be subject to agreement between the manufacturer and the customer. The measuring position distance,  $a_{ch}$ , shall be taken from Table 2.

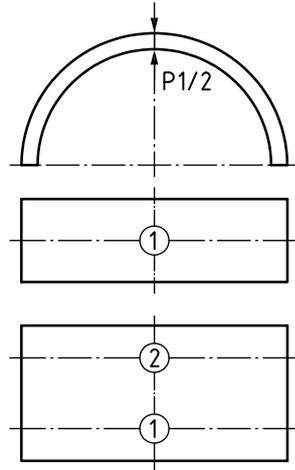
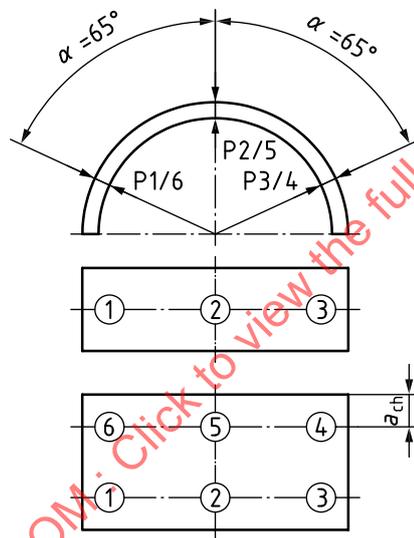
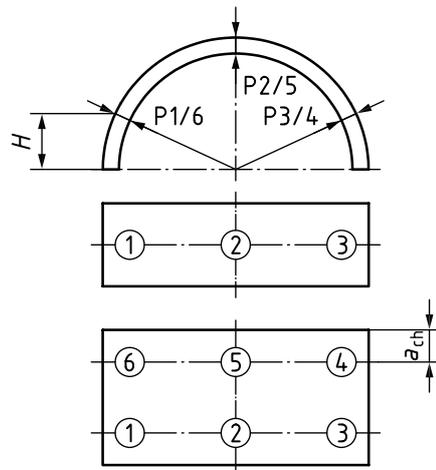


Figure 5 — One- or two-point measuring scheme for half bearings



a) Three- or six-point measuring scheme for half bearings — Method A



b) Three- or six-point measuring scheme for half bearings — Method B

Figure 6 — Three- or six-point measuring scheme for half bearings

Where the bearing design requires variable wall thickness, the measuring points shall be as specified on drawings.

## 6.5 Grading of bearings

Grading is in all cases (circumference-, line- or point measurement) conducted with reference to the measuring points in the crown. When measuring two points or a line at the bearing crown, grading is done by the highest wall thickness value obtained.

## 6.6 Eccentric bore

In special applications, it can be necessary to use an eccentric bore in bearings with or without flange(s). This means that the wall thickness reduces continuously from the crown to the parting line [Figure 7 b)]. Measuring lines or points are defined by angle  $\alpha_2$  (for Method A) or H (for Method B). If nothing is defined,  $\alpha_2 = 25^\circ$ .

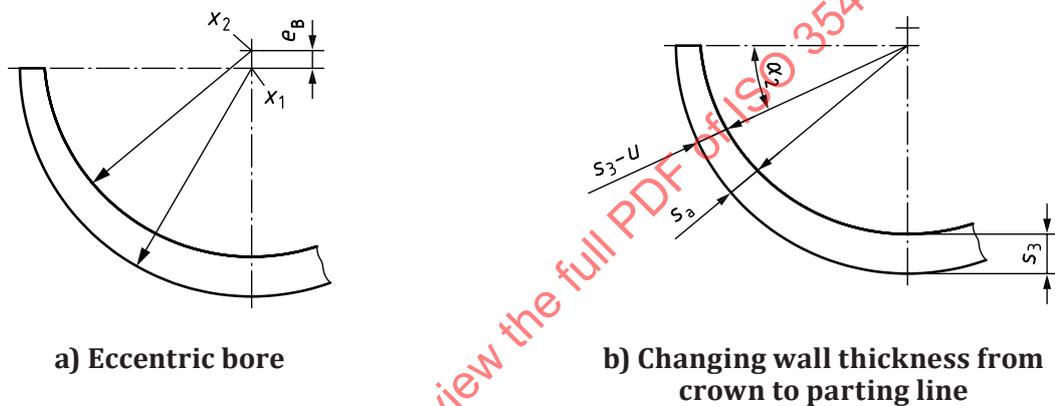


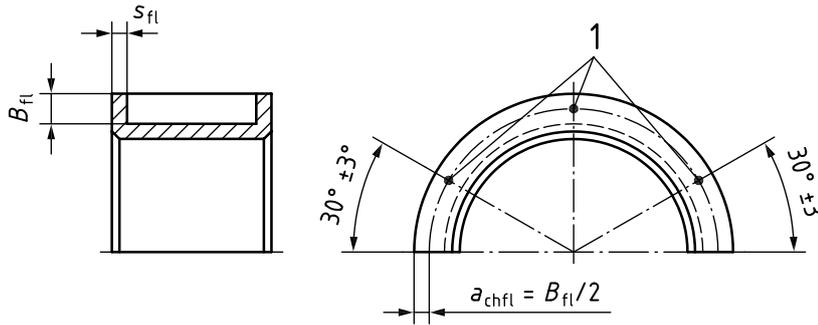
Figure 7 — Principle characterization of eccentric boreing

## 6.7 Measuring principle for flange thickness

The micrometre used for the measurement of flange thickness,  $s_{fl}$ , shall have spherical or needle-like probes. Dust and/or grease on the flange surface shall be removed before the measurement.

## 6.8 Measuring point for flange thickness

Measurement of flange thickness,  $s_{fl}$ , shall be generally carried out at the measuring points specified in Figure 8. In case there are oil grooves influencing the measurement on the measuring surface, the measuring point shall be subject to agreement between the manufacturer and the customer.



**Key**  
 1 measuring point

**Figure 8 — Three-point measuring scheme of flange thickness**

## 7 Requirements for measuring equipment and specimen for the contact method

### 7.1 Tip-radius for measuring pin on the outside surface

The tip-radius at the gauge measuring pin positioned on the outside surface shall be 3,0 mm ± 0,2 mm.

### 7.2 Tip-radius for measuring pin on the inside surface

The tip-radius at the gauge measuring pin positioned on the inside surface shall be as given in [Table 5](#) as a function of the plain bearing outside diameter  $D_0$  and the lining material.

**Table 5 — Tip-radius for measuring pin on the inside surface**

| Nominal outside diameter<br>$D_0$ | Tip-radius for measuring pin on the inside surface<br>mm |                         |
|-----------------------------------|--|-------------------------|
|                                   | Metallic lining material                                 | Plastic lining material |
| $D_0 \leq 10$                     | 1,5 ± 0,2  | 1,5 ± 0,2               |
| $10 < D_0 \leq 25$                | 3 ± 0,2  | 3 ± 0,2                 |
| $25 < D_0 \leq 150$               | 3 ± 0,2  | 5 ± 0,2                 |

### 7.3 Measuring pin load

The measuring pin load  $F_{pin}$  applied onto the lining material shall be 0,8 N to 2,5 N. Load should be set according to the hardness of the lining material (e.g. for soft sliding overlays, low load should be used).

### 7.4 Set-up

The measuring device is set to the nominal value of the thickness by a master block.

### 7.5 Periodical control

The measuring device is checked periodically with the master block from set-up.

The measuring equipment shall be checked for accuracy of measurement at a frequency specified by the user, based on the type of equipment and on experience from previous checks. The limits shall comply with the current industry requirements.