INTERNATIONAL STANDARD

ISO 3547-2

First edition
1999-12-01

Plain bearings — Wrapped bushes —

Part 2:
Test data for outside and inside diameter

Paliers lisses — Bagues roulées —

Partie 2: Données d'essai pour le diamètre extérieur et le diamètre intérieur

Reference number
ISO 3547-2:1999(E)

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.

International Standard ISO 3547-2 was prepared by Technical Committee ISO/TC 123, *Plain bearings*, Subcommittee SC 3, *Dimensions, tolerances and construction details*.

This first edition of ISO 3547-2, together with ISO 3547-1, ISO 3547-3 and ISO 3547-4, cancels and replaces ISO 3547:1976 the technical content of which has been revised and augmented.

ISO 3547 consists of the following parts, under the general title *Plain bearings — Wrapped bushes*:

— *Part 1: Dimensions*

— *Part 2: Test data for outside and inside diameter*

— *Part 3: Lubrication holes, lubrication grooves and lubrication indentations*

— *Part 4: Materials*

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Introduction

Wrapped bushes are not inherently stable when they are in their free condition. After they have been pressed into the bore of the housing, they tend to take up the shape of this bore due to the interference between the outside diameter of the bush and the bore of the housing. For this reason the outside diameter and the inside diameter of wrapped bushes can only be checked with special gauges and test equipment. Thus special test data are required on the drawing to enable this checking to be done.

Plain bearings — Wrapped bushes —

Part 2:
Test data for outside and inside diameter

1 Scope

This part of ISO 3547 specifies test data for outside and inside diameters of wrapped bushes made of solid and mulilayer bearing material for application as plain bearings. It also specifies test designations.

Since the wall thickness of the bush is measured in the free condition, no special test data are required for this on the drawing (see ISO 12307-1 and ISO 12307-2).

NOTE Depending on the manufacturing method the back of the bushes may show isolated light depressions and similarly bushes with lubrication holes, grooves and bore indentations may show distortion. The wall thickness must therefore be measured away from these areas.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 3547. 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 3547 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 3547-1:1999, *Plain bearings — Wrapped bushes — Part 1: Dimensions.*

ISO 3547-4:1999, *Plain bearings — Wrapped bushes — Part 4: Materials.*

ISO 4378-1, *Plain bearings — Terms, definitions and classification — Part 1: Design, bearing materials and their properties.*

ISO 12307-1, *Plain bearings — Checking of wrapped bushes — Part 1: Checking the outside diameter.*

ISO 12307-2:—[1)], *Plain bearings — Checking of wrapped bushes — Part 2: Checking the inside diameter.*

ISO 12301, *Plain bearings — Quality control techniques and inspection of geometrical and material quality characteristics.*

ISO 13715, *Technical drawings — Edges of undefined shape — Vocabulary and indication on drawings.*

3 Term and definition

For the purposes of this part of ISO 3547 the definition of a wrapped bush as given in ISO 4378-1 applies.

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1) To be published.

4 Symbols and units

See Table 1 and Figure 1.

Table 1 — Symbols and units

Symbol	Term	Unit
A_{cal}	Reduced area of cross section (calculated value) of the bush	mm^2
B	Nominal width of the bush	mm
C_i	Inside chamfer	mm
C_o	Outside chamfer	mm
D_i	Nominal inside diameter of the bush	mm
$D_{i,ch}$	Inside diameter of the bush in the ring gauge	mm
D_o	Nominal outside diameter of the bush	mm
F_{ch}	Test force	N
d_{ch}	Diameter of the checking block $d_{ch,1}$ and setting mandrel $d_{ch,2}$	mm
s_1	Thickness of the steel layer [a]	mm
s_2	Thickness of the bearing material layer [a]	mm
s_3	Wall thickness [a]	mm
T	Tolerance of D_o	mm
v	Elastic reduction of the outside diameter under test force F_{ch}	mm
z	Distance apart of the halves of the test housing	mm
Δz	Indicator reading	mm
Δz_D	Circumference indicator reading for test D	mm

[a] For bushes which are made of a single material $s_1 = s_3$ or $s_2 = s_3$

5 Notes pertaining to the data shown on the drawing

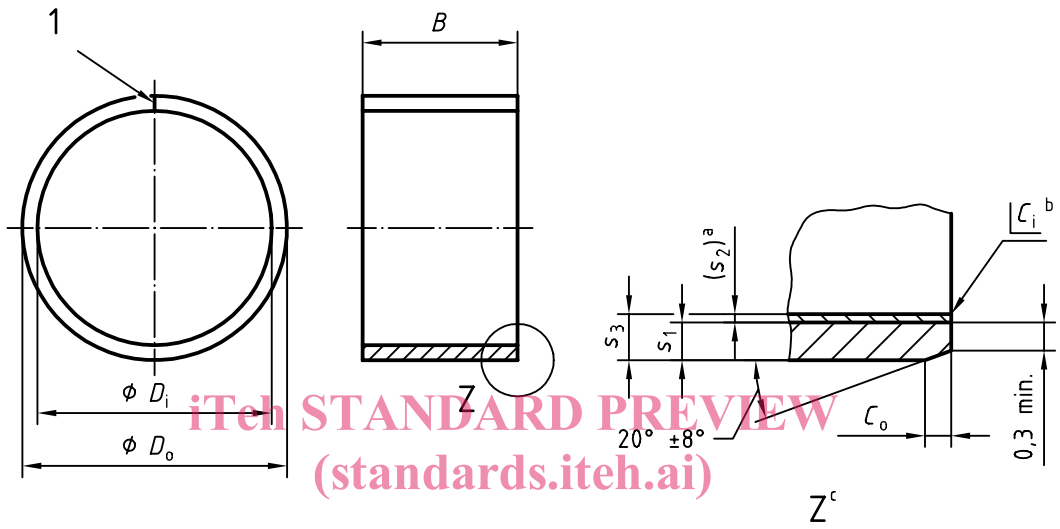
The drawing should show:

— outside diameter D_o and wall thickness s_3, or

— outside diameter D_o and inside diameter D_i.

In no case shall the wall thickness s_3 and the inside diameter D_i both be specified as dimensions that should be checked.

Dimensions in millimetres



Key

1 Split

a Thickness of the bearing material layer: only valid as a basis for calculation in accordance with ISO 3547-1.

b C_i can be a radius or a chamfer, in accordance with ISO 13715.

c Shown on a bush made out of a multilayer material.

Figure 1

6 Types of test

6.1 Test A

Checking the outside diameter D_o in a test rig with checking block and setting mandrel as specified in clause 7.

6.2 Test B

Checking the outside diameter D_o with two ring gauges as specified in clause 8.

6.3 Test C

Checking the inside diameter D_i of a bush pressed into a ring gauge as specified in clause 9.

6.4 Test D

Checking the outside diameter D_o by precision measuring tape as specified in clause 10.

7 Test A

7.1 Description

The test rig consists of a base on which the two parts of the checking block are mounted, see ISO 12307-1.

After the bush has been placed in position with the split at the top, the two halves of the checking block are pressed towards one another using the given test force F_{ch}. The test force causes the bush to be seated into the bore of the checking block in a satisfactory manner.

During the test the outside diameter of the bush is made smaller by the elastic reduction v (see Table 3), however no permanent reduction of the outside diameter takes place. The setting of the indicating device to the correct distance is achieved using a setting mandrel with test force F_{ch} applied. This adjusts the distance z between the two halves of the checking block.

Table 2 — Maximum difference between the diameters of checking block $d_{ch,1}$ and setting mandrel $d_{ch,2}$

D_o		$d_{ch,1} - d_{ch,2}$
>	⩽	max.
–	18	0,006
18	50	0,008
50	80	0,01
80	120	0,012
120	180	0,016

After the bush has been inserted the distance z between the two halves of the checking block changes under the test force F_{ch} and the distance indicator should read Δz. From this the outside bush diameter D_o can be calculated:

$$D_o = d_{ch,2} + v + \frac{2}{\pi} \cdot \Delta z$$

7.2 Calculation basis

7.2.1 Elastic reduction v of outside diameter D_o

The elastic reduction v of the outside diameter is the difference between the outside diameter D_o under zero load and that diameter that is present when the test force F_{ch} is applied. In order to ensure that the bush properly conforms to the surface of the test housing the force F_{ch} must have a certain value. The test force is so fixed that it produces the given elastic reduction v in the outside diameter that is shown in Table 3.

Table 3 — Elastic reduction v of the outside diameter D_o under test force F_{ch}

D_o		v
>	≤	
–	6	0,003
6	12	0,006
12	80	0,013
80	180	0,025

7.2.2 Diameter of the checking block $d_{ch,1}$ and test force F_{ch}

The diameter of the checking block can be calculated from the specified upper limit of the outside diameter from the equation:

$$d_{ch,\,1} = D_{o,\,max} - v$$

By using the figures in Table 3 the values for $d_{ch,1}$ and F_{ch} given in Table 4 are obtained.

Table 4 — Formulae for $d_{ch,1}$ and F_{ch}

D_o	$D_o \leqslant 6$	$6 < D_o \leqslant 12$	$12 < D_o \leqslant 80$	$80 < D_o \leqslant 180$
$d_{ch,\,1}$	$D_{o,\,max} - 0{,}003$	$D_{o,\,max} - 0{,}006$	$D_{o,\,max} - 0{,}013$	$D_{o,\,max} - 0{,}025$
F_{ch}	$1500 \times \frac{A_{cal}}{d_{ch,1}}$ (rounded up to 100 N)	$3\,000 \times \frac{A_{cal}}{d_{ch,1}}$ (rounded up to 250 N)	$6\,000 \times \frac{A_{cal}}{d_{ch,1}}$ (rounded up to 500 N)	$12\,000 \times \frac{A_{cal}}{d_{ch,1}}$ (rounded up to 500 N)
NOTE When calculating F_{ch} the factors 1 500, 3 000, 6 000 or 12 000 have the unit N/mm.				

7.2.3 Reduced cross section area A_{cal}

The nominal size for B, s_1 and s_2 should be put into the following equations.

$A_{cal} = B \times s_1$ for steel, steel/lead alloy, steel/tin alloy and steel/plastic

$A_{cal} = B \times \left(s_1 + \frac{s_2}{2} \right)$ for steel/copper alloy

$A_{cal} = B \times \frac{s_2}{2}$ for copper alloy

$A_{cal} = B \times \left(s_1 + \frac{s_2}{3} \right)$ for steel/aluminium alloy

Lubrication grooves can reduce the cross sectional area A_{cal} depending upon their shape, position and method of manufacture. If the proportion is over 10 % this must be considered in the calculation.

NOTE For bushes which are not made in accordance with ISO 3547-1 the arithmetic average of the two limiting dimensions rounded up to the nearest 0,1 mm should be used for B, s_1 and s_2.