INTERNATIONAL STANDARD

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3547-1

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Plain bearings — Wrapped bushes —

Part 1:
Dimensions

Paliers lisses — Bagues roulées —

Partie 1: Dimensions

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 3547-1 was prepared by Technical Committee ISO/TC 123, *Plain bearings*, Subcommittee SC 3, *Dimensions, tolerances and construction details*.

This first edition of ISO 3547-1, together with ISO 3547-2, 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*

Plain bearings — Wrapped bushes —

Part 1:
Dimensions

1 Scope

This part of ISO 3547 specifies the dimensions and designations of wrapped bushes made of solid and multilayer bearing material for application as plain bearings.

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 3547-2:1999, *Plain bearings — Wrapped bushes — Part 2: Test data for outside and inside diameter.*

ISO 3547-3, *Plain bearings — Wrapped bushes — Part 3: Lubrication holes, lubrication grooves and lubrication indentations.*

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

ISO 4288, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Rules and procedures for the assessment of surface texture.*

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

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

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

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

3 Terms and definitions

For the purposes of this part of ISO 3547 the terms and definitions in ISO 4378-1 apply.

4 Dimensions

See Figure 1 and Tables 1 to 3.

NOTE   All dimensions and tolerances are given in millimetres.

The largest dimension of the inside diameter of the bush when it is in its pressed-in condition is obtained from the largest dimension of the bore in the housing minus twice the smallest dimension of the wall thickness s_3. The smallest dimension of the inside diameter of the bush in its pressed-in condition can be obtained from the smallest dimension of the bore in the housing minus twice the greatest dimension of the wall thickness s_3. This assumes that there is no expansion of the bore in the housing caused by pressing in the bush. In reality the expansion depends on several factors, such as, for example, the stiffness of the housing and the bush. An example of the calculation is given in clause 6.

Instead of the wall thickness the inside diameter $D_{i,ch}$ of the bush can be specified. $D_{i,ch}$ is the inside diameter of the bush, when this is pressed into a ring gauge (Test C – gauging – in accordance with ISO 3547-2:1999, see also ISO 12307-2).

In no case shall wall thickness and inside diameter be given at the same time as the dimensions that should be checked.

Table 4 gives the tolerance for the inside diameter $D_{i,ch}$ of the bush and Table 5 gives the inside diameter of the ring gauge $d_{ch,1}$. The tolerance of the inside diameter of a bush pressed into a housing is found from the sum of the tolerance for $D_{i,ch}$ and the tolerance of the housing bore. As in the case of the calculation of the inside diameter from the wall thickness it is assumed that there is no expansion of the housing bore.

Dimensions for the outside diameter D_o of the bush are given in Table 6.
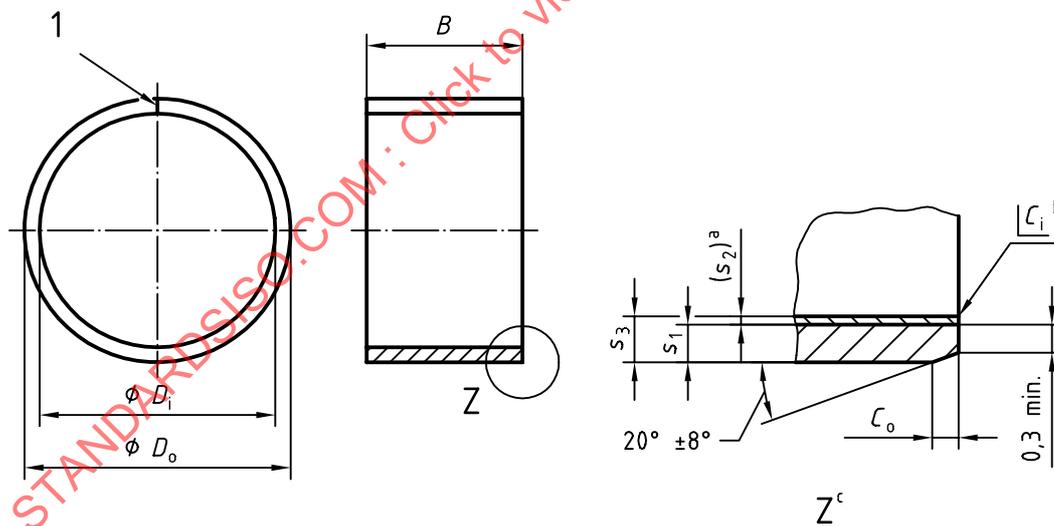
Key

1 Split

^a   Thickness of the bearing material layer: only valid as a basis for calculation in accordance with ISO 3547-2.

a   Thickness of the bearing material layer: only valid as a basis for calculation in accordance with ISO 3547-2.

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

Table 1 — Prefered nominal dimensions for inside diameter D_i, outside diameter D_o, wall thickness s_3 and bush width B

D_i	D_o	s_3	4	6	8	10	12	15	20	25	30	40	50	60	70	80	100
4	5,5	0,75	a	a													
6	8	1		a		a											
8	10	1			a	a	a										
10	12	1				a	a	b									
12	14	1				a		b	b								
13	15	1				a		b	b								
14	16	1						b	b	b							
15	17	1						b	b	b							
16	18	1						b	b	b							
18	20	1						b	b	b							
18	21	1,5						a	b	b							
20	23	1,5						a	b	b	b						
22	25	1,5						a	b	b	b						
24	27	1,5						a	b	b							
25	28	1,5						a			b						
28	31	1,5							b	b	b						
28	32	2							a	a	b						
30	34	2							a		b	b					
32	36	2							a		b	b					
35	39	2							a		b	b					
38	42	2							a		b	b					
40	44	2							a		b	b					
45	50	2,5							a		b	b	b				
50	55	2,5								a		b	b	b			
55	60	2,5									a	b		b			
60	65	2,5									a	b	b		c		
65	70	2,5									a		b		c		
70	75	2,5									a		b		c		
75	80	2,5										b		b		c	
80	85	2,5										b		b		c	c
85	90	2,5										b		b		c	c
90	95	2,5										b		b			c
95	100	2,5												b			c
100	105	2,5											b	b			c
105	110	2,5												b			c
110	115	2,5												b			c
115	120	2,5												b			c
120	125	2,5												b			c
125	130	2,5												b			c
130	135	2,5												b			c
135	140	2,5												b			c
140	145	2,5												b			c
150	155	2,5												b			c
160	165	2,5												b			c
170	175	2,5															c
180	185	2,5															c
200	205	2,5															c
220	225	2,5															c
250	255	2,5															c
300	305	2,5															c

NOTE   Bush widths B outside the tolerance ranges a, b or c should be agreed with the manufacturer and given after the nominal sizes in the standard designation.

If it is necessary to use non-standard widths B then these should be arranged to have an end figure of 2, 5 and 8 up to $D_i = 50$ mm, over $D_i = 50$ mm to have an end figure of 5. Checking of the bush width B in accordance with ISO 12301.

a   Tolerance values for width B: a: $\pm$ 0,25, b: $\pm$ 0,5, c: $\pm$ 0,75.

Table 2 — Outside C_o and inside C_i chamfers

Wall thickness s_3	Chamfer		
	C_o [a]		C_i
	machined	rolled	
0,75	$0,5 \pm 0,3$	$0,5 \pm 0,3$	$-0,4$ $-0,1$
1	$0,6 \pm 0,4$	$0,6 \pm 0,4$	$-0,5$ $-0,1$
1,5	$0,6 \pm 0,4$	$0,6 \pm 0,4$	$-0,7$ $-0,1$
2	$1,2 \pm 0,4$	$1 \pm 0,4$	$-0,7$ $-0,1$
2,5	$1,8 \pm 0,6$	$1,2 \pm 0,4$	-1 $-0,2$
NOTE For bushes which have to be machined to size in the bearing bore (Series C) C_i should be made correspondingly bigger.			
[a] Chamfer C_o machined or rolled at the option of the manufacturer.			

Table 3 — Nominal dimensions and tolerances for wall thickness s_3 and steel layer s_1
of the series A, B, C and D (in accordance with test A of ISO 3547-2:1999)

Nominal dimensions		Wall thickness s_3 tolerance				Thickness of the steel backing in bushes made from multilayer materials s_1 [a]	
		No machining allowance in the bearing bore			With machining allowance in the bearing bore		
		Series A	Series B	Series D	Series C	Range	Tolerance
0,75		0 $-0,015$	0 $-0,020$	–	$+0,25$ $+0,15$	$0,38 \leqslant s_1 \leqslant 0,53$	$\pm 0,08$
1		0 $-0,015$	$+0,005$ $-0,020$	$-0,020$ $-0,045$	$+0,25$ $+0,15$	$0,45 \leqslant s_1 \leqslant 0,68$	$\pm 0,13$
1,5		0 $-0,015$	$+0,005$ $-0,025$	$-0,025$ $-0,055$	$+0,25$ $+0,15$	$0,85 \leqslant s_1 \leqslant 1,1$	$\pm 0,15$
2		0 $-0,015$	$+0,005$ $-0,030$	$-0,030$ $-0,065$	$+0,25$ $+0,15$	$1,3 \leqslant s_1 \leqslant 1,55$	$\pm 0,2$
2,5	$D_o \leqslant 80$	0 $-0,020$	$+0,005$ $-0,040$				
	$80 < D_o \leqslant 120$	0 $-0,025$	$-0,010$ $-0,060$	$-0,040$ $-0,085$	$+0,30$ $+0,15$	$1,8 \leqslant s_1 \leqslant 2,05$	$\pm 0,2$
	$D_o > 120$	0 $-0,030$	$-0,035$ $-0,085$				
NOTE 1 Bushes made from material P1 in accordance with ISO 3547-4:1999 can only be supplied to Series B. For bushes made from material P2 in accordance with ISO 3547-4:1999, series D should preferably be used. NOTE 2 Depending on the manufacturing process used the back of the bushes may show isolated slight depressions. The thickness of the walls should, therefore, be measured at places away from these depressions, thus on "load carrying places".							
[a] The mean steel thickness will depend on the type of lining material.							

Table 4 — Tolerances for the inside diameter $D_{i,ch}$ of the bush in the ring gauge of series W
(in accordance with test C of ISO 3547-2:1999)

D_i nominal	>	–	10	18	30	50	80	120
	≤	10	18	30	50	80	120	175
Tolerances for $D_{i,ch}$		+ 0,036 0	+ 0,043 0	+ 0,052 0	+ 0,062 0	+ 0,074 0	+ 0,087 0	+ 0,100 0
NOTE The concentricity of the inside and outside diameter of the bush shall, unless otherwise agreed, be 0,05 mm.								

Table 5 — Ring gauge inside diameter $d_{ch,1}$ for checking of bush inside diameter $D_{i,ch}$
(in accordance with test C of ISO 3547-2:1999)

D_o nominal	>	–	10	18	30	50	80	120
	≤	10	18	30	50	80	120	180
$d_{ch,1}$[a]		$D_o + 0,008$	$D_o + 0,009$	$D_o + 0,011$	$D_o + 0,013$	$D_o + 0,015$	$D_o + 0,018$	$D_o + 0,020$

[a] The size of the ring gauge inside diameter $d_{ch,1}$ is made up of D_o and the rounded average value of the tolerance field H7.

Table 6 — Dimensions for outside diameter D_o (in accordance with tests A and D of ISO 3547-2:1999)

Test		A								D
D_o nominal	>	–	10	18	30	40	50	80	120	140 [a]
	≤	10	18	30	40	50	80	120	140	–
Tolerance for bushes of	steel, steel/bearing material	+0,055 +0,025	+0,065 +0,030	+0,075 +0,035	+0,085 +0,045	+0,085 +0,045	+0,100 +0,055	+0,120 +0,070	+0,170 +0,100	+0,225 +0,125
	copper alloy	+0,075 +0,045	+0,080 +0,050	+0,095 +0,055	+0,110 +0,065	+0,110 +0,065	+0,125 +0,075	+0,140 +0,090	+0,190 +0,120	+0,245 +0,145

[a] For bushes with $D_o > 140$ mm the outside diameter may be controlled by comparative measurement of the circumference by precision measuring tape in accordance with test D of ISO 3547-2:1999.

Test B of ISO 3547-2:1999. does not stipulate any figure for the outside diameter D_o. In order to obtain a sufficiently tight fit of the bush in the housing bore when using test B experimentally determined gauge inside diameters are used. These depend on the method of manufacture and cannot therefore apply in every single case. Specification of a maximum and minimum pressing in force increases the safety of this test method. The details of test should be agreed for each individual case.

H7 is recommended as the tolerance for the housing bore of wrapped bushes. The thermal expansion coefficient or the stiffness of the housing bore can mean that a different housing bore size is necessary.

The shaft diameter depends on the clearance required in the bearing.

5 Design

In its free state a wrapped bush may not be perfectly cylindrical and its split can be open. After it has been pressed into its housing, in general, a wrapped bush is round and its split is closed. The split should preferably be parallel to the bush axis. Wrapped bushes can be closed by a suitable interlocking of the split. The design of the split is left to the manufacturer.

Wrapped bushes are supplied with or without a machining allowance in the bearing bore. Bushes supplied with a machining allowance are finish machined to the desired dimensions by the customer after they have been pressed into their housings. Such bushes cannot be delivered in all materials.

Wrapped bushes which comply with this part of ISO 3547 are supplied in the accuracy classes A, B, C and D as specified in Table 3 and W as specified in Table 4.

Lubrication holes, lubrication grooves or lubrication pockets should preferably be so designed that they can be stamped or punched. Distortions caused by the wrapping operation are permissible. All edges and corners must be free from loose burrs. Burrs which do not affect installation or function are permissible.

Surface roughness values are given in Table 7.

Table 7 — Surface roughness Ra (in accordance with ISO 4288)

Surface	Surface roughness Ra for bushes μm Series				
	A	B	C	D	W
Bearing bore D_i	0,8 [a]	1,6 [a]	6,3	1,6 [a]	1,6 [a]
Back of bearing D_o	1,6	1,6	1,6	1,6	1,6
Other surfaces	25	25	25	25	25
NOTE Isolated grooves caused by the manufacturing method are permitted on the bearing bore and the back of the bush.					
[a] For bushes made from steel/plastics $Ra \leqslant 6,3$ μm.					

6 Example of the calculation method

Calculation of the size limits of the inside diameter D_i in the pressed in condition:

Bore diameter in housing: $d_H = \left(34^{+0,025}_{0}\right)$ mm

Outside diameter of bush: $D_o = \left(34^{+0,085}_{+0,045}\right)$ mm

Wall thickness of the bush: $s_3 = \left(2^{0}_{-0,015}\right)$ mm

$D_{i,max} = 34,025 - (2 \times 1,985) = 30,055$ mm

$D_{i,min} = 34,000 - (2 \times 2,000) = 30,000$ mm

As a result of interference fit there will be a small expansion of the housing inside diameter d_H after assembly of the bush. This will depend on the rigidity of the housing.