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Plain bearings — Wrapped bushes —

Part 5:
Checking the outside diameter

Paliers lisses — Bagues roulées —

Partie 5: Contrôle du diamètre extérieur

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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.

International Standards are drafted according to the rules given in the ISO/IEC Directives, Part 2.

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.

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International Standard ISO 3547-5 was prepared by Technical Committee ISO/TC 123, *Plain bearings, Subcommittee SC 5, Quality analysis and assurance*.

This part of ISO 3547 cancels and replaces ISO 12307-1:1994, which has been technically revised.

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 diameters*

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

— *Part 4: Materials*

— *Part 5: Checking the outside diameter*

— *Part 6: Checking the inside diameter*

— *Part 7: Measurement of wall thickness of thin-walled bushes*

Plain bearings — Wrapped bushes —

Part 5:
Checking the outside diameter

1 Scope

This part of ISO 3547 specifies, following ISO 12301, the checking of the outside diameter of wrapped bushes (ISO 3547-2:2006, methods A, B and D) and describes the necessary checking methods and measuring equipment.

Wrapped bushes in the free condition are flexible, but after insertion they adapt largely to the shape of the housing bore due to the oversize between the outside diameter of the bush and the housing bore. For this reason, checking of the outside diameter of wrapped bushes can only be carried out under a constraining load by use of specialized measuring equipment.

NOTE 1 The dimensions and tolerances of wrapped bushes are given in ISO 3547-1. Checking the wall thickness is the subject of ISO 3547-7.

2 Normative references

The following referenced documents are indispensable for the application 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 286-2:1988, *ISO system of limits and fits — Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts*

ISO/R 1938-1:1971, *ISO system of limits and fits — Part 1: Inspection of plain workpieces*

ISO 3547-2:2006, *Plain bearings — Wrapped bushes — Part 2: Test data for outside and inside diameters*

3   Symbols and units

Table 1 — Symbols and units

Symbol	Parameter	SI unit
B	Width of the bush	millimetres
$b_{ch, 1}$	Width of the checking block	millimetres
$b_{ch, 2}$	Width of the setting plug	millimetres
d_o	Outside diameter of the ring gauge	millimetres
D_o	Outside diameter of the bush	millimetres
$d_{ch, 1}$	Diameter of the checking block bore (see ISO 3547-2)	millimetres
$d_{ch, 2}$	Diameter of the setting plug (see ISO 3547-2)	millimetres
$d_{ch, a, 1}$	Actual diameter of the checking block	millimetres
$d_{ch, a, 2}$	Actual diameter of the setting plug	millimetres
F_{ch}	Checking load	newtons
C	Correction factor	millimetres
n	Number of test pieces	—
R_a	Surface roughness	micrometres
$t_1 \dots t_6$	Tolerances of form and position	millimetres
x	Length of checking block	millimetres
y	Width of checking block	millimetres
z	Distance between checking block halves	millimetres
ΔD_o	Tolerance of D_o	millimetres
Δz	Indicator reading	millimetres
Δz_D	Circumference indicator reading	millimetres

4   Outside diameter, D_o

For the outside diameter of a wrapped bush, see Figure 1.
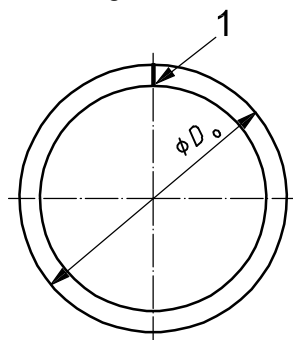
Key

1   split line

NOTE   The free diameter of a wrapped bush is not measured directly because of the flexible nature of the component.

Figure 1 — Outside diameter of a wrapped bush

5 Purpose of checking

The outside diameter shall be checked to ensure the designated mounting compression (interference fit) for the wrapped bush in the housing bore.

6 Methods of checking

NOTE   Checking method C is for measuring the inside diameter and is covered by ISO 3547-6.

6.1 Checking method A — Measurement of outside diameter, D_o

NOTE   See ISO 3547-2.

Check the outside diameter of a wrapped bush using measuring equipment as shown in Figure 2, with a checking block consisting of upper and lower halves (see Figures 3 and 4) and setting plugs (see Figures 5 and 6), at a determined checking load, F_ch.

Measure the outside diameter indirectly as the difference in the value of z, Δz.

The checking load is calculated so that the bush outside diameter is reduced only elastically during checking and that there is no permanent deformation.

6.2 Checking method B — Gauging of outside diameter, D_o

NOTE   See ISO 3547-2.

Check the outside diameter of a wrapped bush in "GO" and "NO GO" ring gauges.

6.3 Checking method D — Measurement of outside diameter, $D_\mathrm{o} > 120$ mm

NOTE   See ISO 3547-2.

Check the outside diameter of a wrapped bush above 120 mm diameter using a precision measuring tape.

7 Selection of checking method for outside diameter

Method A is a precise method involving complex tooling. Method B is an attributive method using simpler tooling. Method D is used only for wrapped bushes with an outside diameter > 120 mm. All three methods are in general use. Method A is generally unsuitable for small bushes up to 10 mm outside diameter but is preferred for bushes over 10 mm outside diameter.

## 8 ISO 3547-2, test A — Outside diameter, D_o

8.1 Measuring equipment

See Tables 2 and 3.

Typical equipment for measuring the bush consists essentially of the following components:

— base plate used as fixture and guiding device for the split checking block;

— means to generate the checking load;

— means to calibrate the load;

— upper plate;

— system for transmitting the distance, z, of both checking block halves to the measuring pin (see Figure 2);

— measuring pin with indicating instrument;

— checking block (see Figures 3 and 4) with setting plug (see Figures 5 and 6).
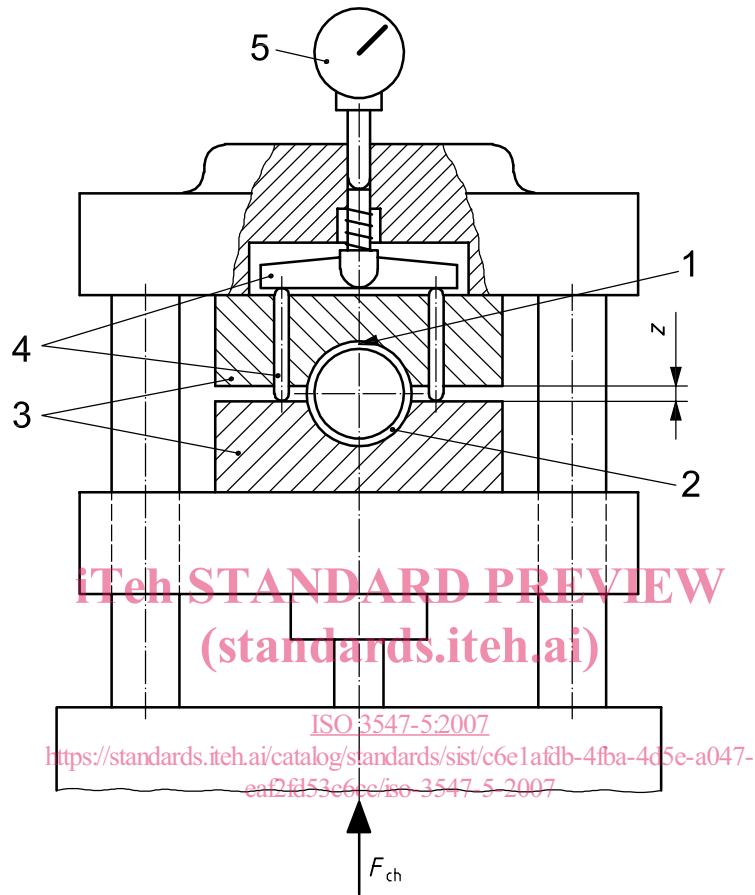
Key

1   split line
2   bush
3   checking block
4   measuring pins
5   indicating instrument

Figure 2 — Typical outside diameter measuring system

Figure 2 shows a typical outside diameter measuring system. This may be operated hydraulically, pneumatically or mechanically.

The force, F_{ch}, may be smoothly applied from the top or from below.

The bush split shall be in the vertical direction and pointing towards the upper checking block.

Table 2 — Checking loads, limiting deviations, speed of approach and temperature

Checking load F_{ch} N		Permissible limiting deviations %	Maximum speed of approach to apply the checking load, F_{ch} mm/s	Test temperature[a] °C
—	$\leqslant 2\,000$	$\pm 1{,}25$		
$> 2\,000$	$\leqslant 5\,000$	± 1	12	20 to 25
$> 5\,000$	$\leqslant 10\,000$	$\pm 0{,}75$		
$> 10\,000$	$\leqslant 50\,000$	$\pm 0{,}5$		
[a] The difference in temperature between the checking block and the bush to be measured shall not exceed 1 °C.				

Table 3 — Deviations for dial gauge and electronic gauge

Dimensions in millimetres

Outside diameter Tolerance ΔD_o		Resolution		Total deviation[a]	
		dial gauge	electronic gauge	dial gauge	electronic gauge
—	$\leqslant 0{,}1$	0,001	0,001	0,001 2	0,5 % of measuring range
$> 0{,}1$		0,005	0,005	0,006	
[a] Maximum measuring value indication (for a full-scale range of ± 500 μm).					

## 8.2 Requirements for checking the block and the setting plug

The requirements for the checking block and the setting plug for measuring the bush outside diameter, D_o, shall be as shown in Figures 3 to 6 and as given in Table 4. Manufacturing tolerances and wear limits are given in Table 5.

Table 4 — Maximum difference between the diameters of the checking block, $d_{ch,\,1}$, and setting plug, $d_{ch,\,2}$, for a usable combination

Dimensions in millimetres

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

Dimensions in millimetres

$x \geqslant 160$ mm

$x \geqslant d_{ch,1} + 90$ mm

$y \geqslant 70$ mm

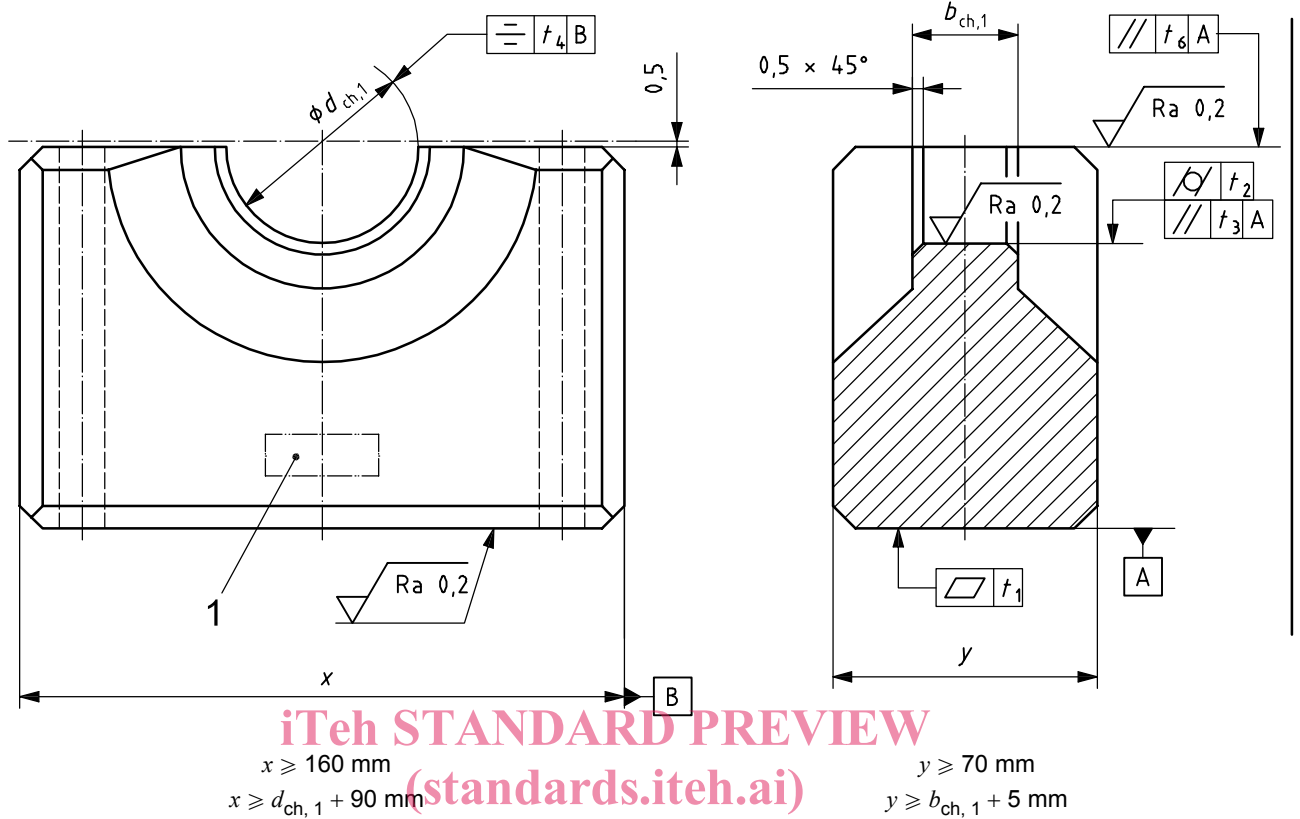$y \geqslant b_{ch,1} + 5$ mm

Key
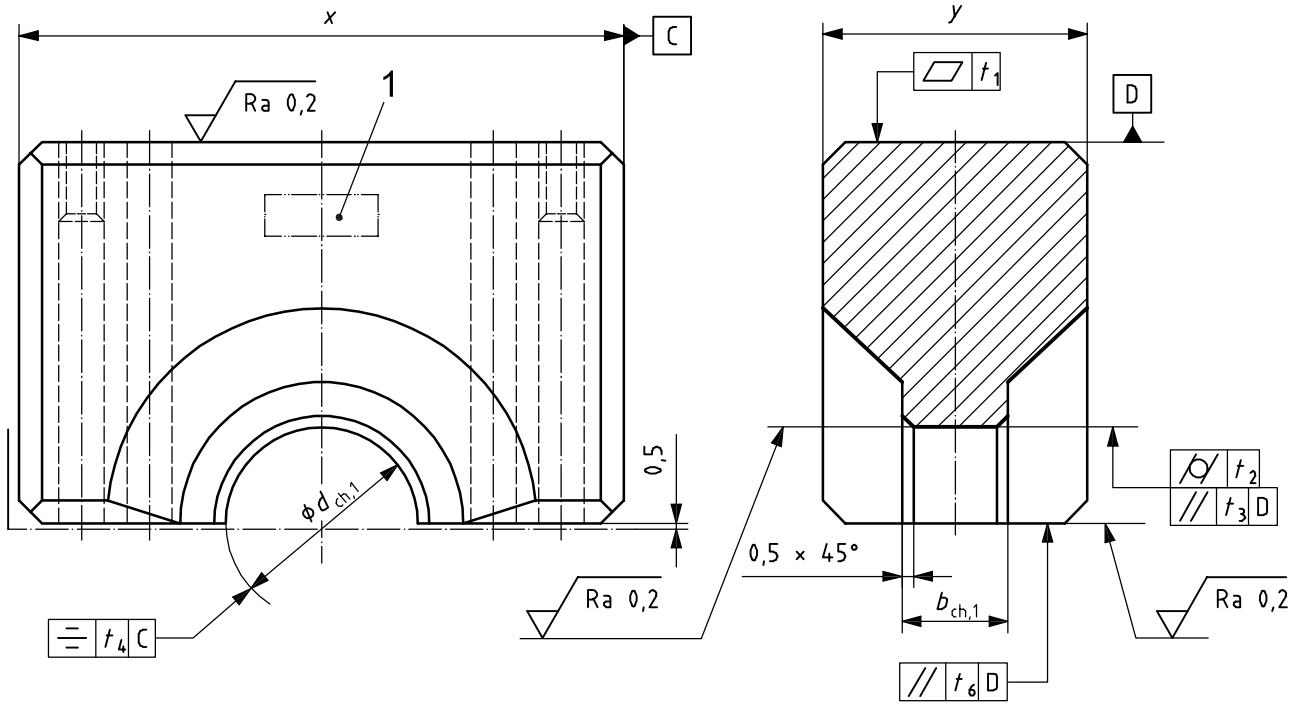
1   field for marking

$b_{ch,1} \geqslant B + 2$

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Figure 3 — Upper half of checking block

Dimensions in millimetres, unless otherwise indicated

$x \geqslant 160$ mm

$x \geqslant d_{ch,1} + 90$ mm

$y \geqslant 70$ mm

$y \geqslant b_{ch,1} + 5$ mm

Key

1   field for marking

$b_{ch,1} \geqslant B + 2$

Figure 4 — Lower half of checking block