



SLOVENSKI STANDARD

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Plain bearings -- Quality control techniques and inspection of geometrical and material quality characteristics

iTeh STANDARD PREVIEW

Paliers lisses -- Techniques de contrôle de la qualité et vérifications des caractéristiques de qualité géométriques et des matériaux

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Ta slovenski standard je istoveten z: [ISO 12301:1992](https://standards.iteh.ai/catalog/standards/sist/56aca6e6-c2f7-419c-bada-24c1b71c101e/sist-iso-12301-2002)

ICS:

21.100.10 Drsni ležaji Plain bearings

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INTERNATIONAL STANDARD

ISO 12301

First edition
1992-12-15

Plain bearings — Quality control techniques and inspection of geometrical and material quality characteristics

iTeh STANDARD PREVIEW
*Paliers lisses — Techniques de contrôle de la qualité et vérifications des
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Reference number
ISO 12301 : 1992 (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.

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 12301 was prepared by Technical Committee ISO/TC 123, *Plain bearings*, Sub-Committee SC 5, *Quality analysis and assurance*.

[SIST ISO 12301:2002](#)

(The draft International Standard was circulated under the number ISO/DIS 8259.)

Annexes A and B of this International Standard are for information only.

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International Organization for Standardization
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Plain bearings — Quality control techniques and inspection of geometrical and material quality characteristics

1 Scope

This International Standard specifies quality control techniques and inspection of the geometrical and material quality characteristics of the following types of plain bearing:

- metallic thin-walled half-bearings, as specified in ISO 3548;
- metallic thin-walled flanged bearings, as specified in ISO 6864;
- metallic thick-walled half bearings (with and without flange) which are manufactured as halves but which are not necessarily interchangeable and have the ratio $s_{\text{tot}} : D_o \geq 0,11$;
- wrapped bushes, as specified in ISO 3547;
- unsplit metallic bushes (with and without flange) made from solid and multilayer materials and with outside diameters up to 230 mm, as specified in ISO 4379;
- thermoplastic bushes (with and without flange) with inside diameters up to and including 200 mm;
- ring-type thrust washers and pressed bimetallic half-thrust washers, as specified in ISO 6525 and ISO 6526, respectively;
- plain bearings made from sintered material, as specified in ISO 2795.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to

agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 286-1 : 1988, *ISO system of limits and fits — Part 1: Bases of tolerances, deviations and fits.*

ISO 468 : 1982, *Surface roughness — Parameters, their values and general rules for specifying requirements.*

ISO 1880 : 1979, *Instruments for the measurement of surface roughness by the profile method — Contact (stylus) instruments of progressive profile transformation — Profile recording instruments.*

ISO 2178 : 1982, *Non-magnetic coatings on magnetic substrates — Measurement of coating thickness — Magnetic method.*

ISO 2795 : 1991, *Plain bearings — Sintered bushes — Dimensions and tolerances.*

ISO 3543 : 1981, *Metallic and non-metallic coatings — Measurement of thickness — Beta backscatter method.*

ISO 3547 : 1976, *Plain bearings — Wrapped bushes — Dimensions, tolerances and methods of checking.*

ISO 3548 : 1978, *Plain bearings — Thin-walled half bearings — Dimensions, tolerances and methods of checking.*

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

ISO 4379 : —²⁾, *Plain bearings — Copper alloy bushes.*

ISO 4384-1 : 1982, *Plain bearings — Hardness testing of bearing metals — Part 1: Compound materials.*

1) To be published. (Revision of ISO 4378-1 : 1983)

2) To be published. (Revision of ISO 4379 : 1978)

ISO 4384-2 : 1982, *Plain bearings — Hardness testing of bearing metals — Part 2: Solid materials.*

ISO 4386-1 : 1992, *Plain bearings — Metallic multilayer plain bearings — Part 1: Non-destructive ultrasonic testing of bond.*

ISO 4386-2 : 1982, *Plain bearings — Metallic multilayer plain bearings — Part 2: Destructive testing of bond for bearing metal layer thicknesses ≥ 2 mm.*

ISO 4386-3 : 1992, *Plain bearings — Metallic multilayer plain bearings — Part 3: Non-destructive penetrant testing.*

ISO 6524 : 1983, *Plain bearings — Methods of dimensional control — Peripheral length checking of thin-walled half bearings.*

ISO 6525 : 1983, *Plain bearings — Ring type thrust washers made from strip — Dimensions and tolerances.*

ISO 6526 : 1983, *Plain bearings — Pressed bimetallic half thrust washers — Features and tolerances.*

ISO 6691 : 1989, *Thermoplastics for plain bearings — Classification and designation.*

ISO 6864 : 1984, *Plain bearings — Thin-walled flanged half bearings — Dimensions, tolerances and methods of checking.*

ISO 12306 : —¹⁾, *Plain bearings — Measurement of wall thickness of thin-walled half-bearings and thin-walled unsplit or wrapped bushes.*

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

3 Definitions

For the purposes of this International Standard, the definitions of technical terms relating to plain bearings given in ISO 4378-1 and the following definitions of terms relating to quality and measurement apply.

3.1 quality of plain bearing: Condition which renders a plain bearing fit to fulfil given requirements. The given requirements are generally dependent upon the intended use.

3.2 quality control techniques: The method, equipment and procedure by means of which the quality of a plain bearing is assessed.

3.3 quality characteristic: Characteristic by means of which the quality of a plain bearing is judged.

3.4 inspection: Checking of one or more quality characteristics of a plain bearing with applicable requirements.

3.5 uncertainty of measurement: The uncertainty of measurement, u , can be calculated using the following formula:

$$u = \pm t \cdot \sigma$$

where

t is the stochastic variable according to Student's t distribution; $t = 2$ and corresponds to a statistical uncertainty in measurement $P = 95 \%$, for which the probability of exceeding the value $(1 - P) = 0,05$ or 5% ;

σ is the standard deviation.

NOTE 1 The uncertainty of measurement is normally included in the tolerance given.

3.6 measuring points [lines]: Agreed points [lines] established to facilitate agreement on testing.

NOTE 2 The establishment of measuring points [lines] does not preclude the need to comply with dimensional specifications in other areas.

3.7 tolerance: Range of acceptable measurements between the upper specified limit and the lower specified limit.

4 Symbols and units

For the purposes of this International Standard, the symbols and units are as given in table 1.

Table 1

Symbol	Parameter	SI Unit
a	Crush height (nip)	mm
Δa	Measured change in a	mm
a_g	Distance between measuring lines	mm
a_E	Distance between gauge faces	mm
a_{fl}	Distance between flanges	mm
A_{eff}	Effective cross-section	mm ²
B	Width	mm
B_{Δ}	Joint displacement	mm
d_c	Diameter of the checking block bore	mm
d_H	Housing diameter	mm
D_{fl}	Flange diameter	mm
D_{ts}	Diameter measured across the joint in the free state; free spread diameter	mm
D_i	Inside diameter	mm
D_o	Outside diameter	mm
E_{red}	Elastic reduction	mm
F_c	Checking load	N
F_{pin}	Checking load (measuring pin)	N
F_{tan}	Tangential load of bearing as fitted	N
h_{Δ}	Joint face taper	mm
H	Height	mm
r	Repeatability	μ m
s_1	Steel thickness	mm
s_2	Bearing lining thickness	mm
$s_{2, red}$	Bearing lining thickness, reduced	mm
s_{fl}	Flange thickness	mm

1) To be published.

Table 1 (concluded)

Symbol	Parameter	SI Unit
s_{tot}	Wall thickness (total)	mm
T	Tolerance	mm
u	Uncertainty of measurement	mm
x_1, x_2, \dots, x_i	Individual measured values	mm
ϵ_{max}	Maximum deformation in compression	mm
ϵ_{min}	Minimum deformation in compression	mm
σ_{tan}	Tangential strength	N/mm ²
ϕ	Stress	N/mm ²

5 Summary of defined quality characteristics

A summary of defined quality characteristics is given in table 2 for the convenience of users of this International Standard, as a guide indicating which defined quality characteristics are relevant to each type of bearing.

The sequence of the characteristics listed in table 2 does not determine their importance. The manufacturer and user shall agree on priorities for the quality characteristics which, from their points of view, are required to assure reliability and life-time of the product.

NOTE 3 A key explaining the meaning of signs used in table 2 is provided at the bottom of the table.

Table 2

Relevant clause/ sub-clause No.	Quality characteristic	Type of plain bearing						
		Thin-walled half-bearing	Thick-walled half-bearing	Wrapped bush	Unsplit metallic bush	Thermo-plastic bush	Sintered bush	Thrust washer (ring and half)
6	Geometrical quality characteristics							
6.1	Wall thickness, s_{tot}							
6.1.1	Line measurement	+	+	+	+	+	-	-
6.1.2	Point measurement	+	+	+	+	+	+	+
6.2	Outside diameter, D_o	-	+	+	+	+	+	+
6.3	Inside diameter, D_i	-	+	+	+	+	+	+
6.4	Width, B	+	+	+	+	+	+	-
6.5	Locating features	+	+	+	+	+	-	+
6.6	Lubricant feed and distribution features	+	+	+	+	+	-	+
6.7	Surface conditions	+	+	+	+	+	-	+
6.8	Crush height, a	+	-	-	-	-	-	-
6.9	Free spread	+	+	-	-	-	-	-
6.10	Straightness of sliding surface	+	-	-	-	-	-	-
6.11	Joint face taper, h_{Δ}	+	-	-	-	-	-	-
6.12	Back contact	+	-	-	-	-	-	-
6.13	Joint displacement, B_{Δ}	-	-	+	-	-	-	-
6.14	Height of thrust half-washer, H	-	-	-	-	-	(+)	+
6.15	Flatness	-	-	-	-	-	(+)	+
6.16	Flange diameter, D_{fl}	+	+	+	+	+	+	-
6.17	Distance between flanges, a_{fl}	+	+	+	+	+	-	-
6.18	Flange thickness, s_{fl}	+	+	+	+	+	+	-
6.19	Perpendicularity (squareness) of flange	+	+	+	+	+	(+)	-
6.20	Geometric deviations							
6.20.1	Cylindricity	-	(+)	-	+	-	(+)	-
6.20.2	Run-out of thrust face	-	(+)	-	+	+	(+)	-
6.20.3	Coaxiality and concentricity	-	+	-	+	+	+	-

Table 2 (concluded)

Relevant clause/ sub-clause No.	Quality characteristic	Type of plain bearing						
		Thin-walled half-bearing	Thick-walled half-bearing	Wrapped bush	Unsplit metallic bush	Thermoplastic bush	Sintered bush	Thrust washer (ring and half)
7	Material quality characteristics							
7.1	Metallic solid material							
7.1.1	Hardness	-	+	-	+	-	-	-
7.1.2	Material composition	-	+	-	+	-	-	-
7.1.3	Material structure	-	+	-	+	-	-	-
7.2	Multilayer metallic material							
7.2.1	Overlay properties	+	+	+	-	-	-	+
7.2.2	Lining properties	+	+	+	-	-	-	+
7.2.3	Backing properties	+	+	+	-	-	-	+
7.2.4	Adhesion (bond) of adjacent layers	+	+	+	-	-	-	+
7.3	Plastic layer material							
7.3.1	Overlay properties	-	-	+	-	-	-	(+)
7.3.2	Lining properties	-	-	+	-	-	-	(+)
7.3.3	Backing properties	-	-	+	-	-	-	(+)
7.3.4	Adhesion (bond) of adjacent layers	-	-	+	-	-	-	(+)
7.4	Thermoplastic material (solid)							
7.4.1	Material composition	-	-	-	-	+	-	-
7.4.2	Material structure	-	-	-	-	+	-	-
7.5	Sintered material							
7.5.1	Material composition	-	-	-	-	-	+	-
7.5.2	Material structure	-	-	-	-	-	+	-
Key								
Plus sign indicates that the characteristic is generally applicable to all types of bearings.								
Plus sign in parentheses indicates that this characteristic is not always applicable.								
Minus sign indicates that the characteristic is not relevant for the corresponding type of bearing.								

6 Geometrical quality characteristics

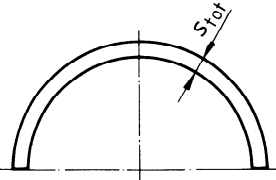
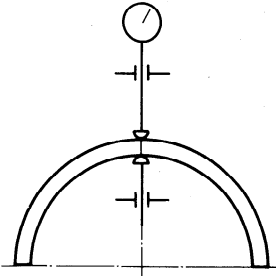
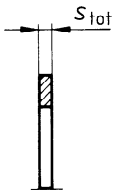
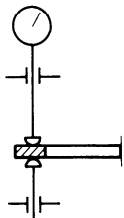
In order to assess plain bearing quality, important dimensional quality characteristics are specified in this clause.

Unless otherwise stated, the dimensions in the tables and figures are given in millimetres.

6.1 Wall thickness, S_{tot}

See table 3.

Table 3

Applicability	Definition of geometrical characteristic to be measured	Test method/measuring principle	Test equipment
Metallic thin-walled half-bearing	See figure 1 and ISO 12306.  <p style="text-align: center;">Figure 1</p>	In accordance with ISO 12306. (See figure 2.) NOTE — This test method is also applicable when measuring joint face bore relief.  <p style="text-align: center;">Figure 2</p>	Device for measuring wall thickness (see also ISO 12306).
Metallic thick-walled half-bearing	See figure 1 and ISO 12306.	Measured normal to the back surface in the radial direction using the spherical faces of the measuring pins, in accordance with ISO 12306. (See figure 2.)	Device for measuring wall thickness.
Wrapped bush	See figure 1 and ISO 12306.	In accordance with ISO 12306. (See figure 2.) NOTE — Depending on the manufacturing process, the back of the wrapped bush may show slight hollows. The wall thickness shall therefore, be measured outside these hollows, i.e. on the 'bearing areas' (see ISO 3547). In the cases $D_i < 8$ or $D_i > 150$, the test method shall be subject to agreement between the manufacturer and user.	Device for measuring wall thickness (see also ISO 12306).
Unsplit metallic bush	See figure 1 and ISO 12306.	In accordance with ISO 12306. (See figure 2.) NOTE — The wall thickness may also be determined by obtaining the difference between the outside and inside diameters ($D_o - D_i$) (see 6.2 and 6.3).	Device for measuring wall thickness (see also ISO 12306).
Thermoplastic bush	See figure 1 and ISO 12306.	In accordance with ISO 12306. (See figure 2.)	Device for measuring wall thickness.
Sintered bush	See figure 1 and ISO 12306.	In accordance with ISO 12306. (See figure 2.)	Device for measuring wall thickness (see also ISO 12306).
Thrust washer	Axial distance between the two faces of the washer (see figure 3).  <p style="text-align: center;">Figure 3</p>	Measured parallel to the axial direction using the spherical faces of the measuring pins (see figure 4).  <p style="text-align: center;">Figure 4</p>	Device for measuring wall thickness.

6.1.1 Line measurement (wall thickness)

See table 4.

Table 4

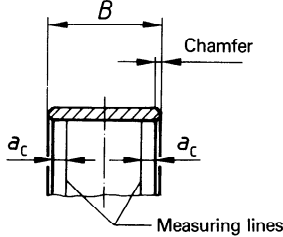
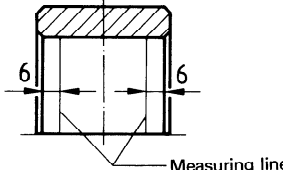
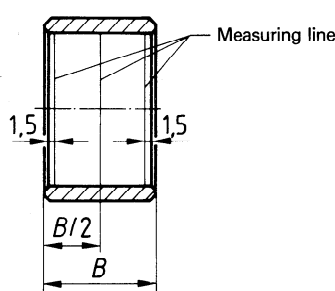
Applicability	Definition of geometrical characteristic to be measured	Test method/measuring principle	Test equipment											
<p>Metallic thin-walled half-bearing; wrapped bush; unsplit metallic bush</p>	<p>See figure 5 and ISO 12306.</p> <p>NOTE — The distance a_c between the measuring lines is measured from the edge of the sliding surface.</p>  <p>Figure 5</p>	<p>The thickness of the half-bearing or bush is measured continuously on one, two or three predetermined or agreed measuring lines, in accordance with ISO 12306. (See figure 5.)</p> <p>NOTE — The defined position of the measuring lines may have to be modified to avoid design features such as grooves, etc.</p>	<p>Device for measuring wall thickness (see also ISO 12306).</p>											
<p>Metallic thick-walled half-bearing</p>	<p>See figure 6 and ISO 12306.</p> <p>NOTE — The distance a_c between the measuring lines ($a_c = 6$) is measured from the edge of the sliding surface.</p>  <p>Figure 6</p>	<p>The thickness of the half-bearing is measured continuously on two predetermined or agreed measuring lines, in accordance with ISO 12306. (See figure 6.)</p> <p>NOTES</p> <ol style="list-style-type: none"> 1 In the case where $s_{tot} > 25$, the test method shall be subject to agreement between the manufacturer and user. 2 The defined position of the measuring lines may have to be modified to avoid design features such as grooves, etc. 	<p>Device for measuring wall thickness; for details see the following table.</p> <table border="1" data-bbox="954 1115 1497 1308"> <thead> <tr> <th>Wall thickness s_{tot}</th> <th>Checking load (measuring pin) F_{pin} N</th> <th>Uncertainty of measurement</th> <th>Radius of measuring anvil</th> </tr> </thead> <tbody> <tr> <td>$s_{tot} < 10$</td> <td>$0,8 < F_{pin} < 1,5$</td> <td>$\pm 0,0015$</td> <td rowspan="2">$3 \pm 0,2$</td> </tr> <tr> <td>$10 < s_{tot} \leq 25$</td> <td>$1,5 < F_{pin} \leq 2,5$</td> <td>$\pm 0,002$</td> </tr> </tbody> </table>	Wall thickness s_{tot}	Checking load (measuring pin) F_{pin} N	Uncertainty of measurement	Radius of measuring anvil	$s_{tot} < 10$	$0,8 < F_{pin} < 1,5$	$\pm 0,0015$	$3 \pm 0,2$	$10 < s_{tot} \leq 25$	$1,5 < F_{pin} \leq 2,5$	$\pm 0,002$
Wall thickness s_{tot}	Checking load (measuring pin) F_{pin} N	Uncertainty of measurement	Radius of measuring anvil											
$s_{tot} < 10$	$0,8 < F_{pin} < 1,5$	$\pm 0,0015$	$3 \pm 0,2$											
$10 < s_{tot} \leq 25$	$1,5 < F_{pin} \leq 2,5$	$\pm 0,002$												

Table 4 (concluded)

Applicability	Definition of geometrical characteristic to be measured	Test method/measuring principle	Test equipment											
Thermo-plastic bush	<p>See figure 7 and ISO 12306.</p> <p>NOTE — The distance a_c between the measuring lines ($a_c = 1,5$) is measured from the edge of the sliding surface.</p>  <p style="text-align: center;">Figure 7</p>	<p>The thickness of the bush is measured continuously on one, two or three predetermined or agreed measuring lines, in accordance with ISO 12306. (See figure 7.)</p> <p>NOTE — The defined position of the measuring lines may have to be modified to avoid design features such as grooves, etc.</p>	<p>Device for measuring wall thickness; for details see the following table.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Outside diameter D_o</th> <th>Checking load (measuring pin) F_{pin} N</th> <th>Radius of measuring anvil</th> <th>Uncertainty of measurement</th> </tr> </thead> <tbody> <tr> <td>$D_o \leq 150$</td> <td>$0,8 \leq F_{pin} \leq 1,5$</td> <td>$3 \pm 0,2$</td> <td rowspan="2">$\pm 0,005$</td> </tr> <tr> <td>$150 < D_o \leq 300$</td> <td>$1,5 < F_{pin} < 2,5$</td> <td>$5 \pm 0,2$</td> </tr> </tbody> </table>	Outside diameter D_o	Checking load (measuring pin) F_{pin} N	Radius of measuring anvil	Uncertainty of measurement	$D_o \leq 150$	$0,8 \leq F_{pin} \leq 1,5$	$3 \pm 0,2$	$\pm 0,005$	$150 < D_o \leq 300$	$1,5 < F_{pin} < 2,5$	$5 \pm 0,2$
Outside diameter D_o	Checking load (measuring pin) F_{pin} N	Radius of measuring anvil	Uncertainty of measurement											
$D_o \leq 150$	$0,8 \leq F_{pin} \leq 1,5$	$3 \pm 0,2$	$\pm 0,005$											
$150 < D_o \leq 300$	$1,5 < F_{pin} < 2,5$	$5 \pm 0,2$												

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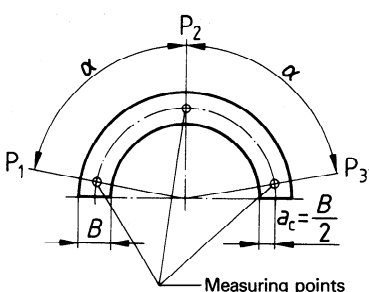
6.1.2 Point measurement (wall thickness)

See table 5.

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Table 5
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Applicability	Definition of geometrical characteristic to be measured	Test method/measuring principle	Test equipment
Metallic thin-walled half-bearing; wrapped bush; unsplit metallic bush	<p>Wall thickness measured at determined measuring points (see ISO 12306).</p>	<p>In accordance with ISO 12306.</p> <p>NOTE — The defined position of the measuring points may have to be modified to avoid design features such as grooves, etc.</p>	<p>Device for measuring wall thickness (see also ISO 12306).</p>
Metallic thick-walled half-bearing	<p>Wall thickness measured at determined measuring points which are subject to agreement between the manufacturer and user.</p>	<p>In accordance with ISO 12306.</p> <p>NOTE — The defined position of the measuring points may have to be modified to avoid design features such as grooves, etc.</p>	<p>External micrometer with dial indicator.</p>
Thermo-plastic bush; sintered bush	<p>Wall thickness measured at determined measuring points (see ISO 12306).</p>	<p>In accordance with ISO 12306.</p> <p>NOTE — The defined position of the measuring points may have to be modified to avoid design features such as grooves, etc.</p>	<p>External micrometer with dial indicator.</p> <p>Device for measuring wall thickness (see also ISO 12306).</p>

Table 5 (concluded)

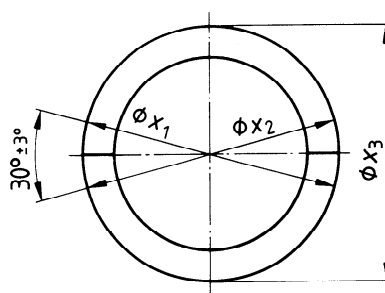
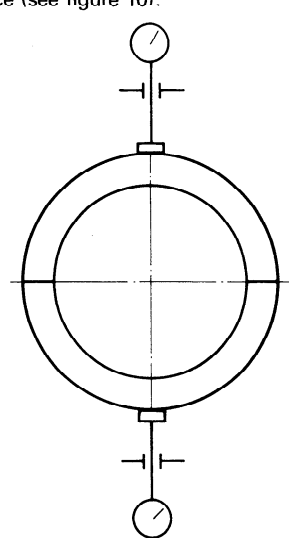
Applicability	Definition of geometrical characteristic to be measured	Test method/measuring principle	Test equipment						
Thrust washer	<p>Wall thickness measured at determined measuring points (P) on measuring lines at a distance a_c from the inside diameter of the washers, as shown in figure 8.</p>  <p>Thrust half-washers: $\alpha = 80^\circ$ Thrust washers: $\alpha = 120^\circ$</p> <p>Figure 8</p>	<p>The thrust washer is measured at measuring points positioned as shown in figure 8.</p> <p>NOTE — The defined position of the measuring points may have to be modified to avoid design features such as grooves, etc.</p>	<p>External micrometer with dial indicator.</p> <p>Device for measuring wall thickness; for details see the following table.</p> <table border="1" data-bbox="941 560 1484 739"> <thead> <tr> <th>Checking load (measuring pin) F_{pin} N</th> <th>Radius of measuring anvil</th> <th>Uncertainty of measurement</th> </tr> </thead> <tbody> <tr> <td>$0,8 < F_{pin} < 1,5$</td> <td>$3 \pm 0,2$</td> <td>$\pm 10\%$ of tolerance</td> </tr> </tbody> </table>	Checking load (measuring pin) F_{pin} N	Radius of measuring anvil	Uncertainty of measurement	$0,8 < F_{pin} < 1,5$	$3 \pm 0,2$	$\pm 10\%$ of tolerance
Checking load (measuring pin) F_{pin} N	Radius of measuring anvil	Uncertainty of measurement							
$0,8 < F_{pin} < 1,5$	$3 \pm 0,2$	$\pm 10\%$ of tolerance							

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6.2 Outside diameter, D_o

See table 6.

SIST ISO 12301:2002
<https://standards.itech.ai/catalog/standards/sist/56aca6e6-c2f7-419c-bada-24c1b71c101e/sist-iso-12301-2002>
Table 6

Applicability	Definition of geometrical characteristic to be measured	Test method/measuring principle	Test equipment
Metallic thick-walled half-bearing	<p>Outside diameter of a metallic thick-walled half-bearing measured as a pair in the free condition, determined using the following formula:</p> $D_o = \frac{x_3 + 0,5(x_1 + x_2)}{2}$  <p>Figure 9</p>	<p>Measured in the radial direction between two flat parallel faces of the measuring device (see figure 10).</p>  <p>Figure 10</p>	<p>Measuring device.</p> <p>Holding device.</p> <p>Uncertainty of measurement: $\pm 10\%$ of the tolerance on outside diameter.</p>
Wrapped bush	See ISO 12307.	In accordance with ISO 12307.	In accordance with ISO 12307.