
INTERNATIONAL STANDARD



3547

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Plain bearings — Wrapped bushes — Dimensions, tolerances and methods of checking

Paliers lisses — Bagues roulées — Dimensions, tolérances et méthodes de contrôle

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FOREWORD

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Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 3547 was drawn up by Technical Committee ISO/TC 123, *Plain bearings*, and was circulated to the Member Bodies in November 1974.

It has been approved by the Member Bodies of the following countries :

Australia	India	South Africa, Rep. of
Austria	Italy	Spain
Bulgaria	Mexico	Sweden
Czechoslovakia	Netherlands	Turkey
Finland	New Zealand	United Kingdom
France	Poland	U.S.S.R.
Germany	Romania	Yugoslavia

The Member Body of the following country expressed disapproval of the document on technical grounds :

U.S.A.

Plain bearings – Wrapped bushes – Dimensions, tolerances and methods of checking

1 SCOPE AND FIELD OF APPLICATION

This International Standard lays down the main dimensions and tolerances of a range of wrapped bushes, with external diameters of between 6 and 150 mm, for plain bearings.

These limits are not the result of present manufacturing techniques but are intended to cover the most widely used sizes. Below 6 mm and above 150 mm, manufacture is generally still possible.

NOTE – All the dimensions and tolerances are expressed in millimetres, unless otherwise indicated.

Clause 2 defines and describes a wrapped bush, in order to avoid confusion with other parts of similar shape but for different use, such as, for example, split dowel pins, and to draw attention to certain peculiarities in the construction of wrapped bushes. However, work has not yet been completed on vocabulary and all terms in this International Standard must be considered as temporary only.

As certain dimensions and tolerances of wrapped bushes cannot, because of the very nature of these parts, be directly measured, it was considered necessary to specify

the methods for checking these dimensions and tolerances in clause 4.

2 DEFINITION AND DESCRIPTION

A wrapped bush is a cylindrical bearing, having a continuous split from one end to the other, manufactured from rolled material. This split may or may not be parallel to the axis of the cylinder. In its free state, the wrapped bush may not be perfectly cylindrical, and its split may be open. The split is closed when the wrapped bush is fitted in its housing.

In certain cases, wrapped bushes with the split closed by a suitable interlocking (clinched) joint may be produced.

Defects on the backs of bushes that have been caused by details made on the strip material before forming, such as holes, grooves or indentations, are permitted.

Wrapped bushes may, in general, be supplied with or without an allowance for machining in the bore. In the first case, they will be finished in a suitable way after they have been fitted in their housings.

TABLE 1 – Housing diameters, shaft diameters and bush wall thickness

Preferred ¹⁾ housing diameters	Non-preferred housing diameters	Shaft diameters for given wall thickness							
		0,75	1	1,5	2	2,5	3	3,5	4
6		4,5	4						
7		5,5	5						
8		6,5	6						
9		7,5	7						
10		8,5	8						
11		9,5	9						
12		10,5	10						
13		11,5	11						
14		12,5	12						
15			13	12					
16			14	13					
17			15	14					
18			16	15					
19			17	16					
20			18	17					
21			19	18					
22			20	19					
24	23		21	20					
25			22	21					
			23	22					
26				23	22				
28	27			24	23				
30				25	24				
32				27	26				
34				29	28				
36				31	30				
38				33	32				
	39			35	34				
40				36	35				
42				37	36				
	44			39	38				
				41	40				
45				42	41	40			
48				45	44	43			
50				47	46	45			
53				50	49	48			
56	55				51	50	49		
	57				52	51	50		
60					53	52	51		
63					56	55	54		
	65				59	58	57		
67					61	60	59		
	70				63	62	61		
71					66	65	64		
75					67	66	65		
80					71	70	69		
					76	75	74		
85						80	79	78	
90						85	84	83	
95						90	89	88	
100						95	94	93	
105						100	99	98	
110						105	104	103	
	115					110	109	108	
120						115	114	113	
125						120	119	118	
130							124	123	122
140							134	133	132
150							144	143	142

1) Based on the R' 40 series of preferred numbers (ISO 497).

3 DIMENSIONS AND TOLERANCES

3.1 Dimensions

The basic nominal dimensions – housing (internal) diameter and bush wall thickness – are given in table 1.

3.2 Housing diameter tolerances

The ISO tolerances H8, H7 or H6 shall be chosen according to the available machining facilities and the final precision required.

In the case of non-rigid housings or housings made of material with a high thermal expansion coefficient, grades 8, 7 or 6 shall be maintained but the deviation may be different from H.

3.3 Shaft diameter tolerances

These shall be chosen according to the application and in particular according to the operational clearances permitted by the user.

3.4 Wall thickness tolerances

These depend on the materials used and the manufacturing techniques. Slight surface depressions are acceptable on the outside surface of the bushes provided that they are randomly distributed; however, thickness measurement shall not be carried out in these areas.

3.4.1 Bushes to be finished by the user

The manufacturing tolerances shall be :

- ± 0,035 on 0,75 thickness
- ± 0,05 on 1 – 1,5 – 2 and 2,5 thicknesses
- ± 0,065 on 3 – 3,5 and 4 thicknesses

Finer tolerances may be agreed between user and manufacturer, especially when the wrapped bushes are finished by methods other than machining.

3.4.2 Bushes finished by the manufacturer, known as "precision bushes"

Although only the thickness of a wrapped bush is directly measurable, one may, by applying the method of checking given in 4.3.4, check the internal diameter obtained when the bush is fitted in a rigid housing of known diameter and calculate the coaxiality of the bore by measuring the thickness at diametrically opposed points of minimum and maximum wall thickness.

The method of indication of coaxiality (see table 2) is shown in figure 1. The method and its interpretation are in accordance with ISO/R 1101.

The axis to the dimension of which the tolerance frame is connected shall be contained in a cylinder of diameter "e" coaxial with the axis of the datum A.

TABLE 2 – Tolerance on internal diameter and coaxiality for precision bushes

Housing diameter	Tolerance on internal diameter of the bush	Coaxiality tolerance e
≤ 50	0,025	0,025
> 50 ≤ 80	0,035	0,030
> 80 ≤ 120	0,050	0,040
> 120 ≤ 150	0,070	0,050

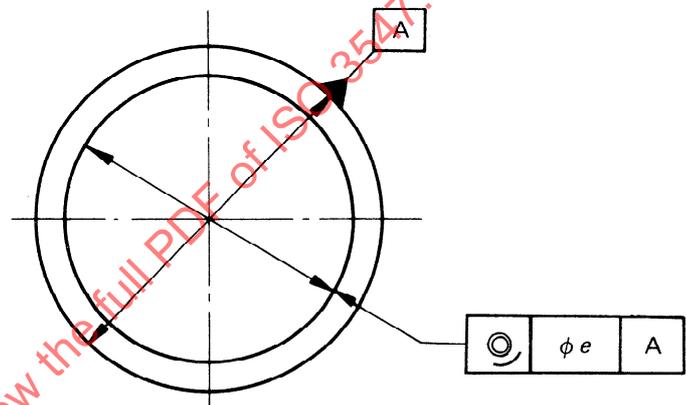


FIGURE 1 – Indication of coaxiality

3.5 Widths of wrapped bushes

The recommended bush widths for given housing diameters are given in table 3.

TABLE 3 – Width of wrapped bushes

Housing diameters	Width – tolerance on widths ± 0,25*											
	5	10	15	20	25	30	40	50	60	70	80	100
6 and 7	X	X										
8 to 10		X	X									
11 to 15		X	X	X								
16 to 20			X	X	X							
21 to 25			X	X	X	X						
26 to 34				X	X	X	X					
36 to 48					X		X	X				
50 to 57					X		X		X			
60 to 67						X		X		X		
70 to 80							X		X		X	
85 to 150								X		X		X

* Wider tolerances may be accepted by agreement between the user and the manufacturer.

3.6 Construction details

3.6.1 Chamfers

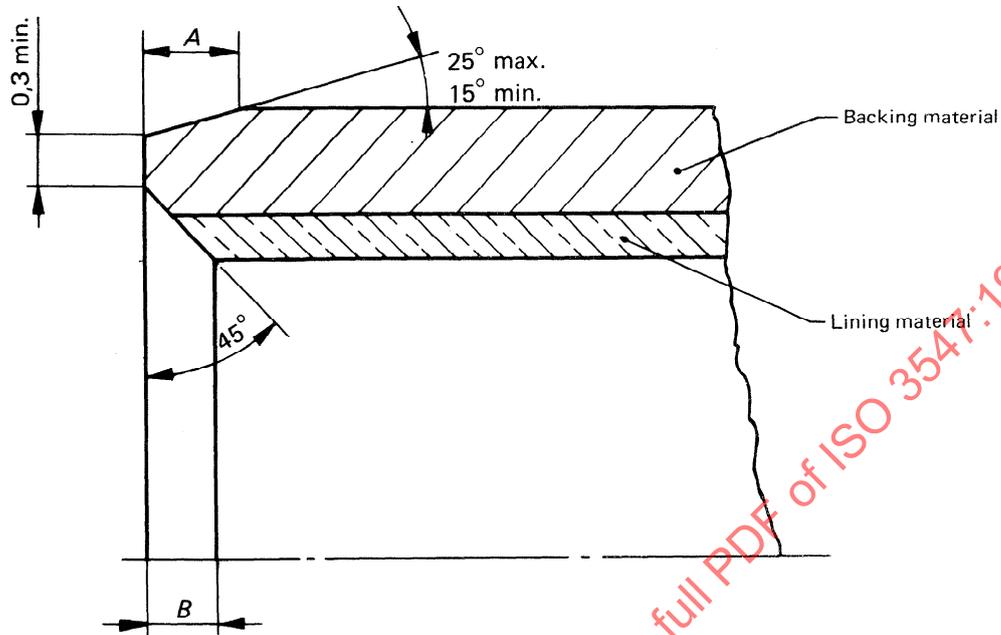


FIGURE 2 – Chamfer angles

Dimension *B* is not standardized. The internal chamfer angle, when it exists, is equal to 45° and then *B* is as shown in the third column of table 4.

TABLE 4 – Chamfers

Housing diameters	External chamfer <i>A</i>	Internal chamfer <i>B</i> (guidance only)
11 to 25	0,4 to 1	0,5
26 to 80	0,8 to 1,6	0,7
85 to 150	1 to 2,5	1

NOTES

- To facilitate fitting, the housing shall have a chamfer of narrow angle.
- Bushes of wall thickness 0,75 mm and bushes of diameter less than 10 mm are normally not chamfered but all edges shall be free of burrs.
- Chamfers may be produced by methods other than machining, in which case the form, angle and the length of the chamfers shall be agreed between the user and the manufacturer.

3.6.2 Lubricating holes

3.6.2.1 Lubricating holes are normally pierced in the strip before wrapping, and are thus distorted after wrapping, so that their diameter cannot be directly defined.

Lubricating holes are specified by the diameter of a plug gauge which can be fitted in the hole, and by the minimum permissible distance between the hole and each end of the bush. See figure 3.

The size of the lubricating holes shall be not less than 1,5 times the wall thickness of the bush, with a minimum size of 3 mm.

Holes of a smaller diameter may be accepted by agreement between the manufacturer and the user.

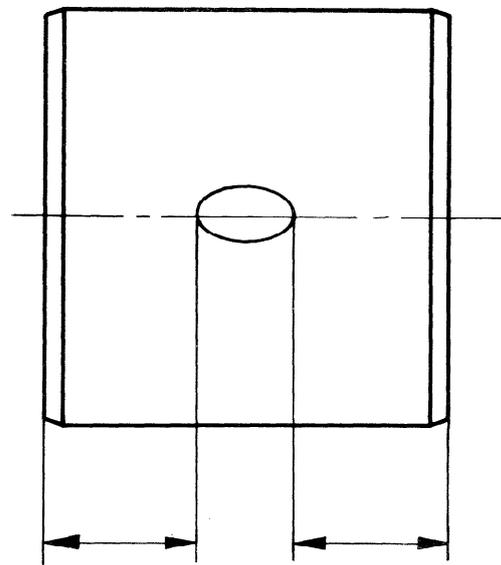


FIGURE 3 – Lubricating hole

3.6.2.2 The pierced holes may not be situated in the zones represented by the shaded areas shown in figure 4.

symmetry, and its interpretation, are in accordance with ISO/R 1101.

3.6.2.3 When the pierced hole is positioned symmetrically in the blank before forming, the developed view of the bush shall be as shown in figure 5. This method of indicating

3.6.2.4 Lubricating holes may be drilled after wrapping, in which case their location need not be restricted as indicated in figure 4. They shall be defined by their diameter with a tolerance of $\pm 0,25$.

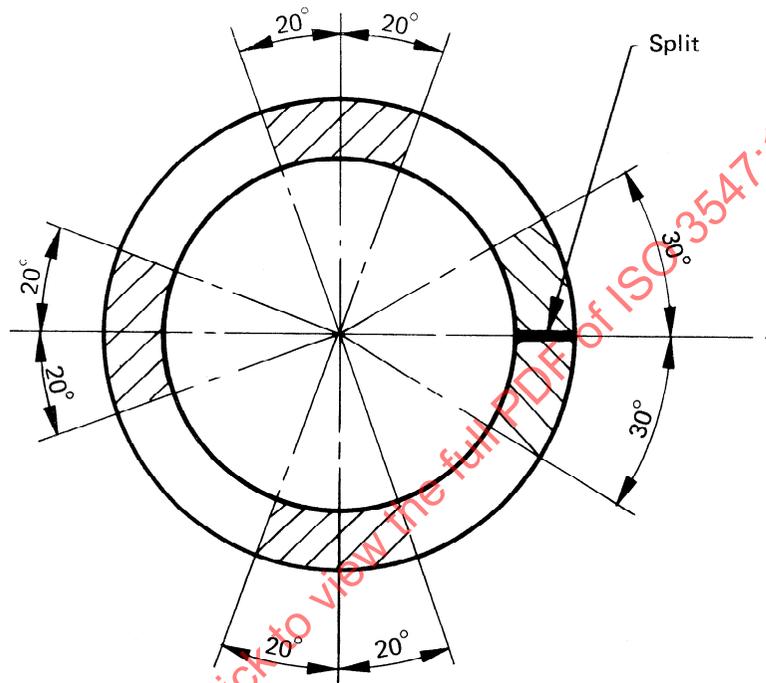


FIGURE 4 – Restriction on position of lubricating holes

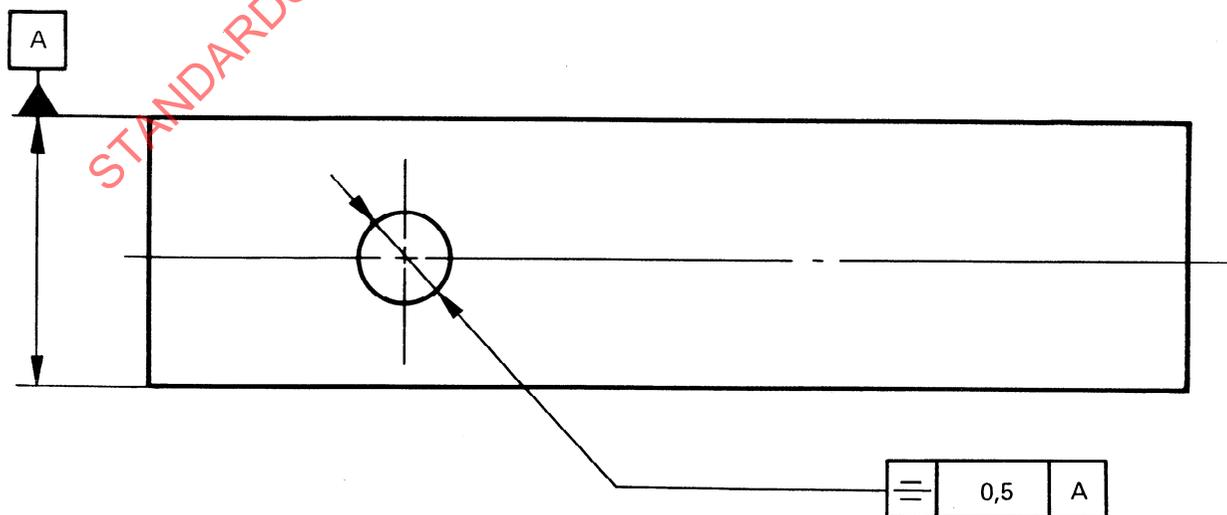


FIGURE 5 – Bush with hole – Developed view

3.6.3 Grooves

3.6.3.1 GROOVE FORMS

The grooves are normally formed in the strip before wrapping. They become distorted after wrapping.

The width of the groove l , the radius R and the angle θ shall be given as nominal values, without tolerances.

The typical forms are shown in figure 6.

3.6.3.2 GROOVE DEPTH

The maximum depths of the grooves shall be as indicated in table 5.

TABLE 5 – Depth of grooves

Wall thickness	Maximum depth P
0,75	0,25
1	0,3
1,5	0,5
2 or greater	0,6

For ease of measurement it is, however, the thickness of the wall remaining at the base of the groove which shall be specified on the drawing, with a tolerance of $\pm 0,1$.

NOTES

- 1 The maximum depth may be reduced for certain lining materials.
- 2 A swelling of maximum 0,1, due to the stamping operation, surrounding the groove is permissible.
- 3 Cracks in the lining material are permitted in the grooves, provided that particles of lining do not become detached.
- 4 If grooves are required deeper than the maximum specified above, they shall be machined.

3.6.3.3 POSITION OF THE GROOVES

For a central annular groove, the developed view of the bush shall be as shown in figure 7. This method of indicating symmetry, and its interpretation, are in accordance with ISO/R 1101.

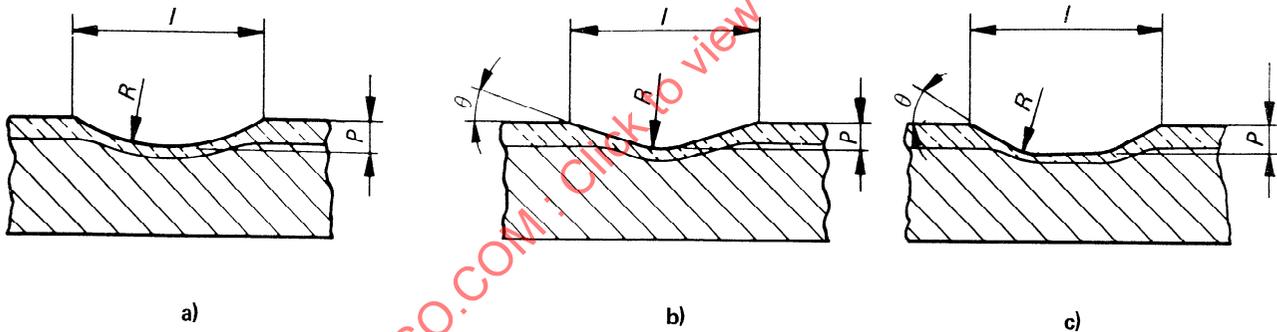


FIGURE 6 – Groove forms

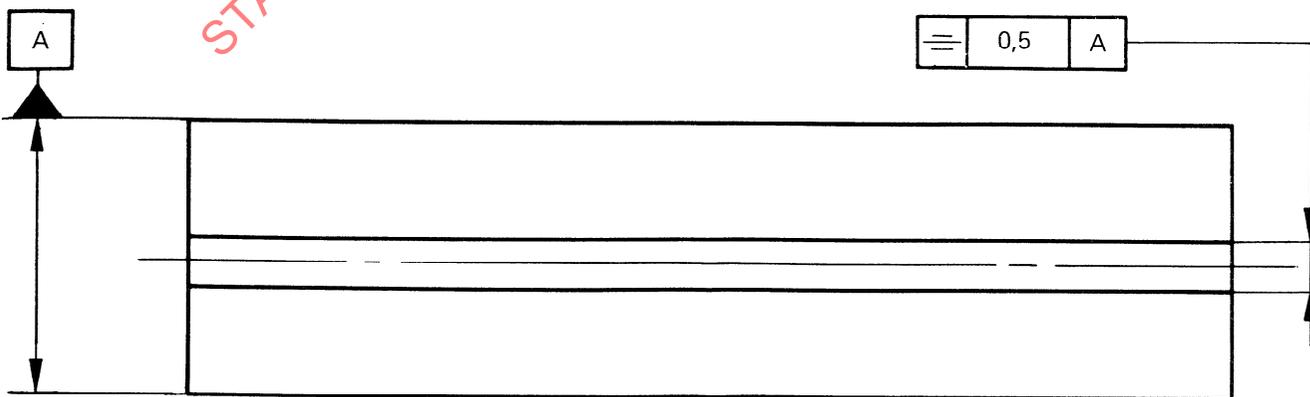


FIGURE 7 – Bush with central annular groove – Developed view

Helical grooves should not run onto the end faces less than 5 mm from the joint; see figure 8.

4 METHODS OF CHECKING

4.1 Preliminary comments

The external diameter of wrapped bushes cannot be measured in the free state. One of the three checking methods given below may be used, but all are not usable over the whole range of bushes covered by this International Standard.

The accuracy of the check varies according to the method adopted, and methods A, B and C below correspond to decreasing degrees of accuracy.

4.2 Checking methods

4.2.1 Method A

Checking of the peripheral length under a load in the apparatus described in 4.3.1.

Measurement of the wall thickness¹⁾ (see 4.3.3).

4.2.2 Method B

Checking of the external diameter by insertion of the wrapped bush into GO and NOT GO gauges (see 4.3.2).

Measurement of the wall thickness¹⁾ (see 4.3.3).

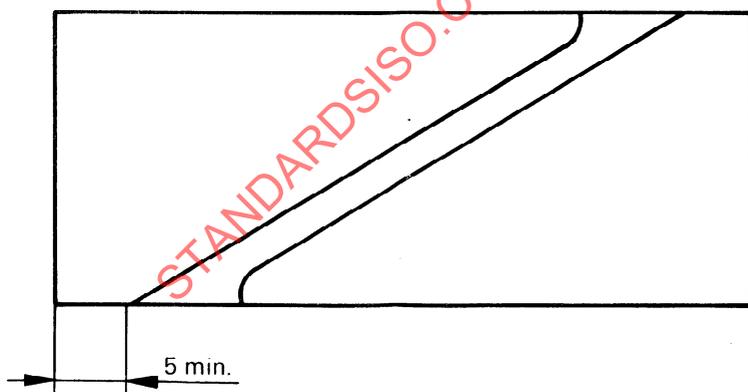


FIGURE 8 – Bush with helical groove – Developed view

4.2.3 Method C

Checking of the external diameter as in Method B.

Checking of the internal diameter by GO and NOT GO plug gauges, the wrapped bush being fitted in a ring gauge of known diameter (see 4.3.4).

4.3 Checking procedures

4.3.1 Checking of the peripheral length under a load

4.3.1.1 APPARATUS AND PROCEDURE

The apparatus used (see figure 9) consists essentially of a checking gauge of internal diameter D cut lengthwise into two equal parts called "checking blocks" which can move towards each other under the action of a force F known as the "checking load".

When a solid cylindrical plug gauge of nominal diameter D is placed between the checking blocks and a force F is applied, there is a gap h between the parting lines of the checking blocks.

The apparatus is fitted with a suitable device capable of measuring the variations of h . The procedure described above is used to effect the initial setting of the measuring device.

To check a batch of wrapped bushes of theoretical external diameter in the free state d , successively place each bush between the checking blocks, apply the checking load, and read the variation of h .

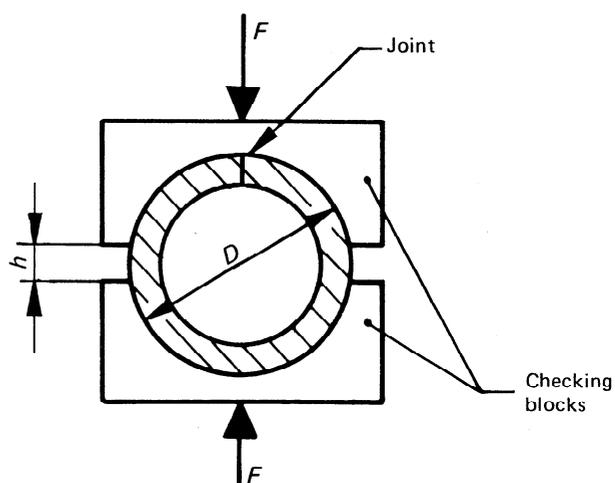


FIGURE 9 – Apparatus for checking of peripheral length under load

1) In certain cases (for example bores finished by the manufacturer), in addition to the measurement of the thickness, the internal diameter of the wrapped bush, after insertion in a gauge, may be checked as in method C or measured using a suitable means of measurement.