International Standard ISO 6524

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Plain bearings — Methods of dimensional control — Peripheral length checking of thin-walled half bearings

Paliers lisses — Méthodes de contrôle dimensionnel — Contrôle de la longueur développée des demi-coussinets minces

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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 developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been authorized 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.

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 6524 was developed by Technical Committee ISO/TC 123, *Plain bearings*, and was circulated to the member bodies in December 1981.

It has been approved by the member bodies of the following countries:

Czechoslovakia	Netherlands	United Kingdom
Egypt, Arab Rep. of	Poland	USA
France	Romania	USSR
India	Spain	
Italy	Sweden	

The member body of the following country expressed disapproval of the document on technical grounds:

Germany, F.R.

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Annexes

Plain bearings — Methods of dimensional control — Peripheral length checking of thin-walled half bearings

1 Scope and field of application

This International Standard specifies the methods of checking the measuring equipment and gauging tools which are necessary for the measurement of the peripheral length (or nip) of thin-walled half bearings.

Thin-walled half bearings are flexible and, in the free condition, do not conform to a cylindrical profile. This is one reason why the peripheral length of the half bearings can only be measured under a constraining load by use of specialized measuring equipment.

In addition, measuring equipment different from that illustrated in this International Standard can be used, providing the measuring values determined with this equipment are within the tolerances of repeatability, reproducibility and comparability given in clause 17.[1]

This International Standard does not include measurement of the joint face taper.

This International Standard applies to thin-walled half bearings the specifications of which are given in ISO 3548 and ISO 6864.

2 References

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

ISO 5725, *Precision of test methods — Determination of repeatability and reproducibility by inter-laboratory tests.*

ISO 6864, *Plain bearings — Thin-walled flanged half bearings — Dimensions, tolerances and checking methods.*[2]

3 Definitions

3.1 peripheral length: The circumferential length which runs from one joint face to the other.

3.2 nip (crush) : Size S_N by which a half bearing fitted in a checking block of bore diameter D_{cb} under a predetermined checking load F exceeds the defined peripheral length of the checking block bore (see figure 1).

NOTE — In practice, the datum serves as a basis for measuring S_N (see figure 2).

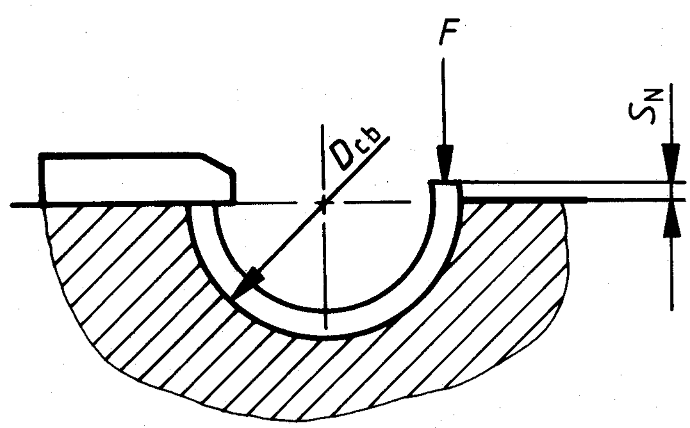

Figure 1 — Nip

1) These three concepts and their definitions conform to ISO 5725, but the mathematical formulae used for the calculation in this International Standard (see annex E) have been simplified.

2) At present at the stage of draft.

4 Purpose of checking

It is necessary to keep to the nip tolerances of ISO 3548 and ISO 6864 in order to guarantee the designated mounting compression (interference fit) for the half bearings in the housing bore.

5 Symbols

NOTE — The characteristic subscripts are the following:

- bs: bearing to be checked
- cb: checking block
- cbs: series checking block
- cs: master shell

S_N or $S_{N1} + S_{N2}$ = nip, in millimetres

$F = F_1 = F_2$ = checking load, in newtons

CF = correction factor, in millimetres [1)]

PL = peripheral length, in millimetres [1)]

D_{cb} = diameter of the checking block bore, in millimetres [1)]

H_{cb} = distance from the bottom of the checking block bore to the datum plane, in millimetres [1)]

B_1 = checking block width (construction for flanged half bearings), in millimetres

B_3 = checking block width (construction for half bearings without flange), in millimetres

B_2 = checking block width, in millimetres

K_1 = checking block chamfer (construction for half bearings without flange), in millimetres

K_2 = checking block chamfer (construction for flanged half bearings), in millimetres

D_{bs} = outside diameter of the half bearing to be checked, in millimetres

e_T = total wall thickness of the half bearing, in millimetres

L = width of the half bearing without flange, in millimetres

Z = distance between flanges of the flanged half bearing, in millimetres

h = fillet radius between back and flange on flanged half bearing, in millimetres

d_{cs} = outside diameter of the master shell, in millimetres [1)]

L_{cs} = master shell width, in millimetres

s_{cs} = wall thickness of the master shell, in millimetres

δ = correction to compensate the difference of elastic deflections under load between method A and method B, in millimetres

f = coefficient in calculation of deflection under load, in millimetres/newton

Δ = deviation of the actual peripheral length of the checking block, in millimetres

ΔH_{cb} = elastic deformation of the height of the checking block under load, in millimetres

E_e = elastic depression of the toe piece, in millimetres

6 Methods of checking

6.1 Checking method A

The checking load, F, is directly applied via the measuring head with a pivoting toe piece to one joint face of the half bearing whereas the other joint face is in contact with a fixed stop (see figure 2).

6.2 Checking method B

The checking loads F_1 and F_2 are applied via a measuring head and two toe pieces to both joint faces of the half bearing (see figure 3).

7 Selection and designation of the checking method

7.1 Selection of the checking method

Recommendations for the selection of method A or B are given in table 1 based upon the dimensions of the half bearings to be checked.

However, any size of bearing may be tested by either method by agreement between manufacturer and user. In that case, a correction δ should be applied to compensate for the difference in deflections at joint face(s) under load between method A and method B and such that:

$$S_N = S_{N1} + S_{N2} + \delta$$

(See also 16.5 and clause E.3 in annex E.)

Table 1

D_{bs} mm above	D_{bs} mm up to and including	Recommended method of checking
—	160	A
160	340	A or B
340	500	B

1) The symbol may be followed by a subscript that defines the gauging tool to which the symbol is applied and/or by the subscript "M" or "th" indicating an effective measured value or a theoretical value respectively.

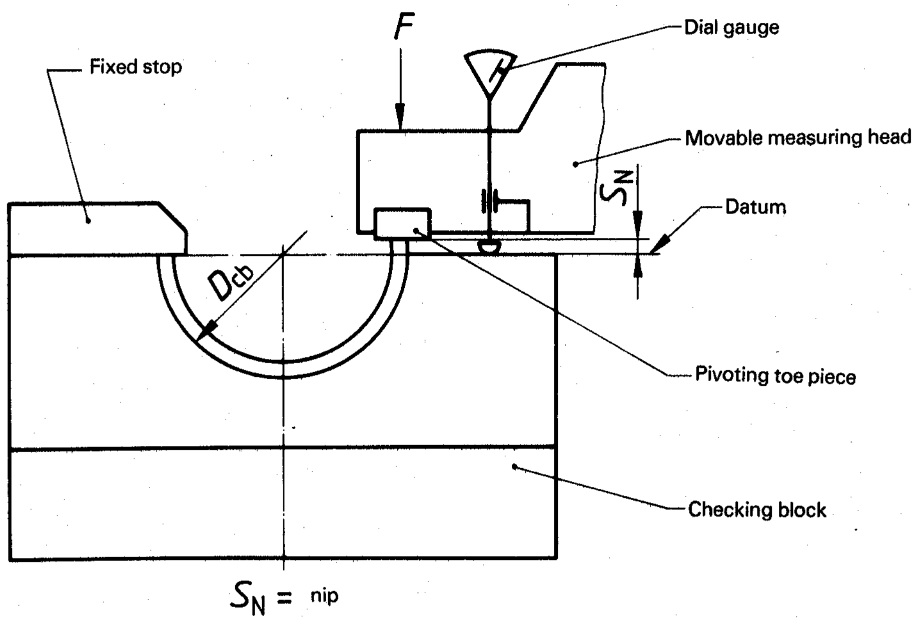

Figure 2 — Principle of checking method A

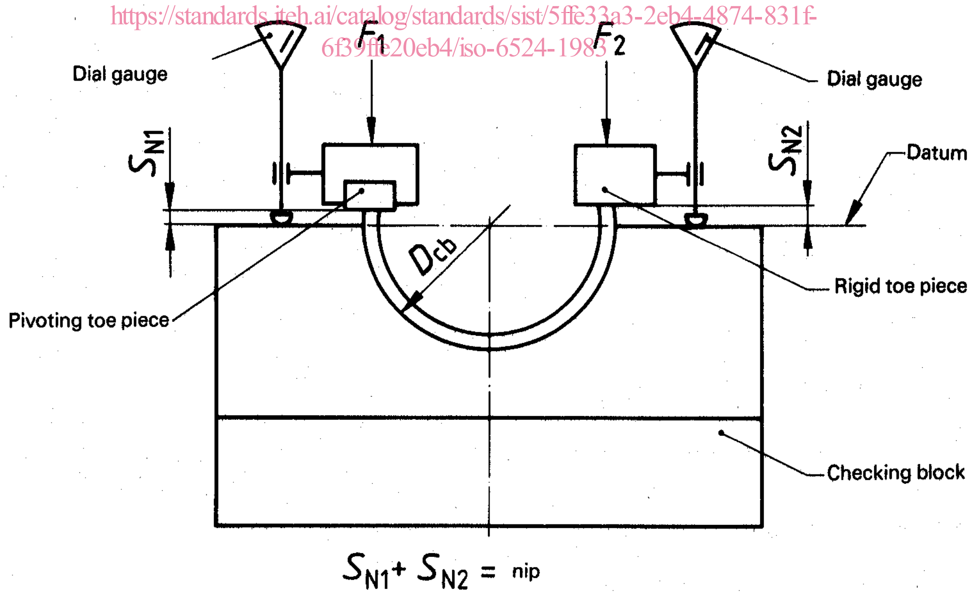

Figure 3 — Principle of checking method B

NOTE — In the case of checking method A, the fixed stop exerts the required counter-force which, in the case of checking method B, is applied directly by the measuring equipment via two toe pieces.

Example : Method A $F = 6\,000$ N

Method B $\left\{ \begin{array}{l} F_1 = 6\,000 \text{ N} \\ F_2 = 6\,000 \text{ N} \end{array} \right.$

7.2 Designation of the checking method

Example for the designation of method A for checking thin-walled half bearings with an outside diameter, D_{bs}, of 340 mm:

Method ISO 6524 — A — 340

8 Measuring equipment

Figures 4 and 5 show typical measuring equipment for the measurement of the nip (crush) for method A and method B respectively.

8.1 Measuring equipment for method A

See figure 4.

8.2 Measuring equipment for method B

See figure 5.

9 Measuring equipment requirements

In the following the most important points, that have a substantial effect on the accuracy of measuring equipment and consequently on the measured nip values, are specified.

9.1 Tolerance of checking load setting

The permissible tolerances are given in table 2.

Table 2

F N above	F N up to and including	Tolerance for F ± %
—	2 000	1,25
2 000	5 000	1,0
5 000	10 000	0,75
10 000	50 000	0,5
50 000	—	0,25

9.2 Speed of approach of measuring head

The checking load, F, shall be applied to the joint face(s) of the half bearing so that shock load will not occur. Maximum speed of approach : 10 mm/s.

9.3 Construction of measuring head

The measuring head must be so constructed that it is accurately guided and moves normal to the datum of the checking block. The deviation from parallelism between the toe piece(s) in the measuring head and the supporting plane of the checking block shall not exceed 0,04 mm per 100 mm in a radial direction.

9.4 Accuracy of the measuring plane of the toe pieces

Specifications for the accuracy of the measuring plane of the toe pieces are given in table 3.

Table 3

D_{bs} mm above	D_{bs} mm up to and including	Surface roughness R_a µm	Tolerance of flatness mm
—	160	0,2	0,001 5
160	340	0,4	0,003
340	500		0,004

9.5 Accuracy of the dial gauge

Total deviation : ± 0,6 µm

Scale graduation value : 1 µm

10 Gauging tools for establishing the datum

The following equipment is available as the case may be, to carry out measurements :

— a master checking block (for reference measurements), see clause 11;

— a series checking block (for series control), see clause 11;

— a master shell (for series control), see clause 12.

They can be used in three possible ways (see 10.1, 10.2 and 10.3) in order to establish the datum against which dial gauges are set for checking.

10.1 Master checking block (alone)

The master checking block is the basis of comparison for the other checking blocks used for series control.

10.2 Series checking block alone

The peripheral length of the bore of this type of checking block is determined by comparison with the master checking block.

It is applied in series control without using a master shell.

10.3 Series checking block with master shell

The peripheral length of the checking block bore is determined by the master shell, the peripheral length of which was obtained in the master checking block.

This combination of gauging tools is applied in series control.

NOTE — For series control, a checking block may also be used with a checking master but this combination of gauging tools is not within the scope of this International Standard.

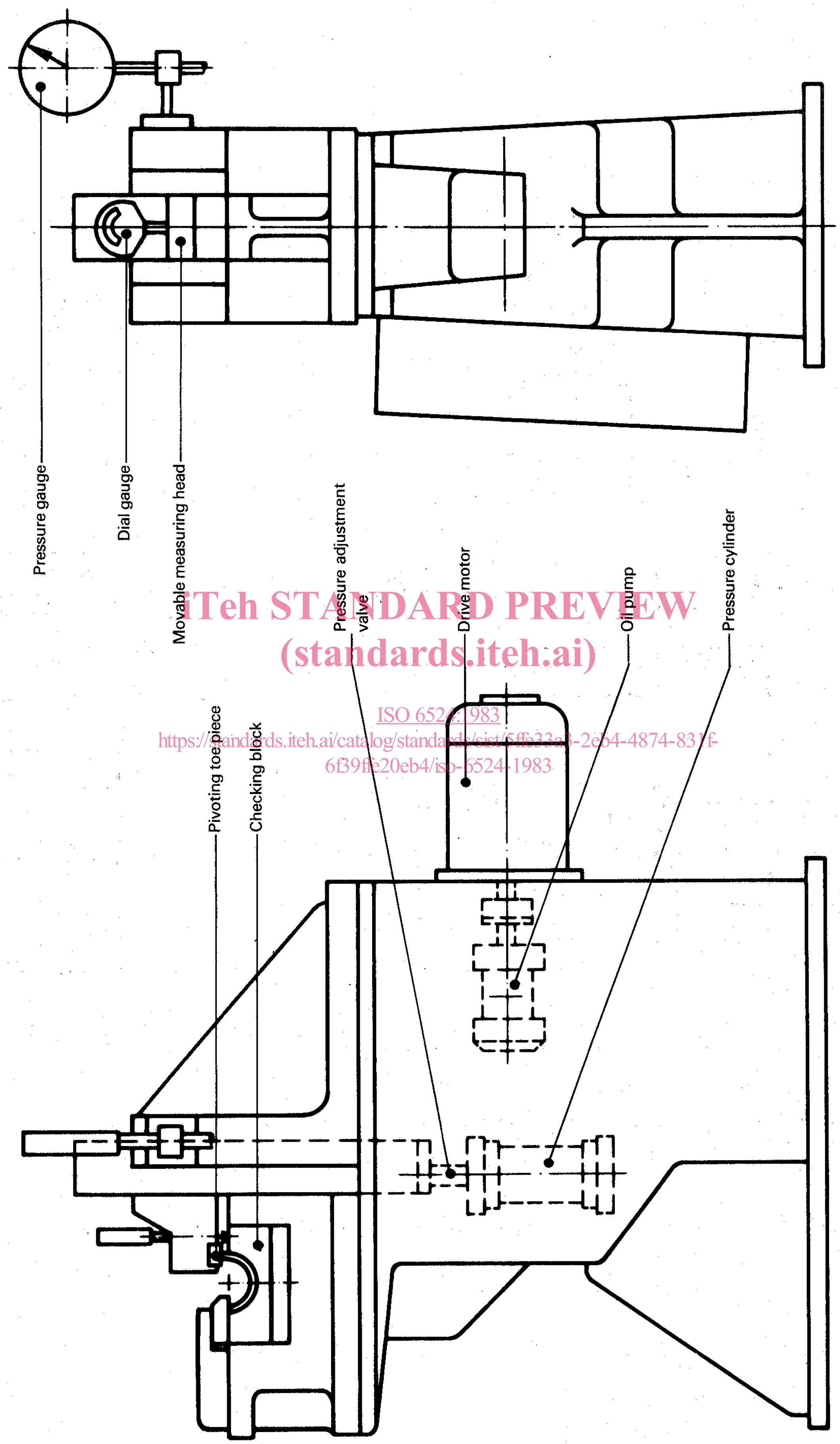

Figure 4 — Typical measuring equipment with one column for checking method A

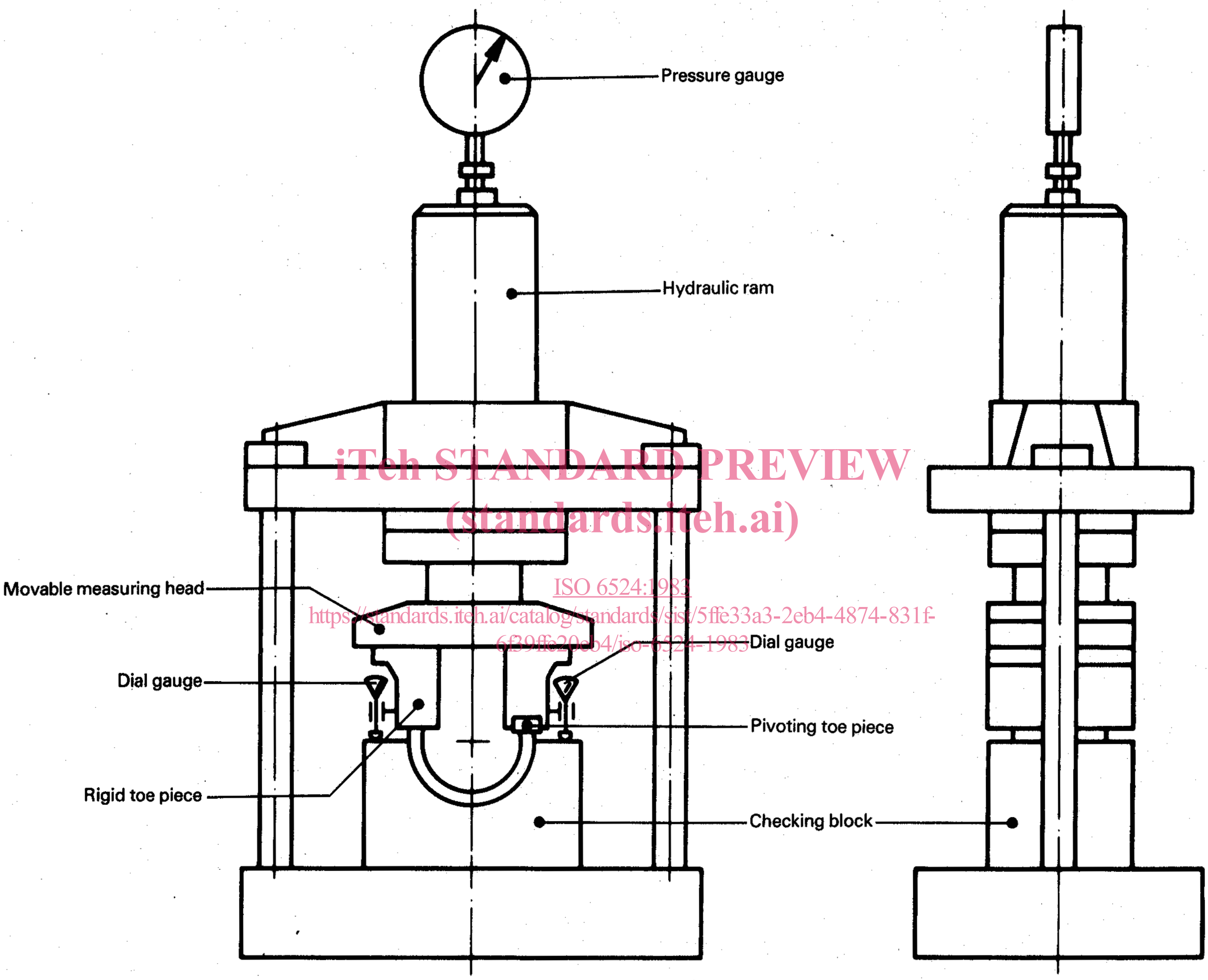

Figure 5 — Typical measuring equipment with two columns for checking method B

NOTE — Figures 4 and 5 show hydraulically operated equipment. Pneumatically or mechanically operated equipment may also be used.

11 Checking block requirements

The checking block is a typical block as shown in figure 6, the gauging part of which has a bore diameter D_{cb} and height H_{cb} and is intended to admit the half bearings to be checked.

The checking block should preferably be of hardened steel and of rigid construction so that requirements in clause 16 are met when the half bearing is tested under load.

The bore of the checking block shall not be chromium plated.

Recesses shall be cut into the checking block to accommodate the nick in the half bearings (see 16.2).

11.1 Reference tooling: master checking block

11.1.1 Manufacturing limits

Manufacturing limits and specifications for the master checking block are given in table 4.

11.1.1.1 Tolerances of form and orientation

It is the responsibility of the manufacturer of the master checking block to achieve high quality regarding tolerances of form and orientation.

The values for t_1 to t_7 are 50 % of those shown in tables 6 and 7.

11.1.1.2 Values for surface roughness a_1 and a_2 : see tables 6 and 7.

11.1.1.3 Specifications for B_1, B_2 and B_3 : see tables 6 and 7.

11.1.2 Measuring accuracy of equipment used for establishing D_{cbM} and H_{cbM}

Determination of D_{cbM} and H_{cbM} must be carried out by measuring equipment within a tolerance of :

± 0,000 5 mm for $D_{cb} \leqslant 160$ mm
± 0,001 0 mm for $D_{cb} > 160$ mm

These values are necessary for calculating the correction factor CF_{cb} (see 13.1) via the peripheral length, which is calculated from the formula:

$$PL_M = D_{cbM} \times \frac{\pi}{2} + 2\left(H_{cbM} - \frac{D_{cbM}}{2}\right)$$

11.1.3 Permissible wearing limit

No wear is permitted for the master checking block.

11.2 Series gauging tools

11.2.1 Series checking block alone

Since the peripheral length of this checking block bore is determined by comparison with the master checking block (11.1), larger tolerances for D_{cb} and H_{cb} are accepted.

11.2.1.1 Manufacturing limits

Manufacturing limits and specifications for the series checking block are given in tables 5 to 7.

11.2.1.2 Correction factor, CF_{cbs}

For calculation of CF_{cbs}, see 13.2.1.

Table 4

D_{bs} mm above	D_{bs} mm up to and including	Tolerance for D_{cb} mm	Surface roughness of checking block bore, R_a µm	Tolerance for H_{cb} mm	Surface roughness of the datum, R_a µm
–	75	+ 0,003 0		+ 0,003 0 0	
75	110	+ 0,004 0	0,2	+ 0,003 5 0	0,3
110	160	+ 0,005 0		+ 0,004 0 0	
160	250	+ 0,006 0	0,4	+ 0,004 5 0	0,6
250	340	+ 0,007 5 0	0,6	+ 0,005 0 0	1,0
340	500	+ 0,01 0		+ 0,006 0 0	

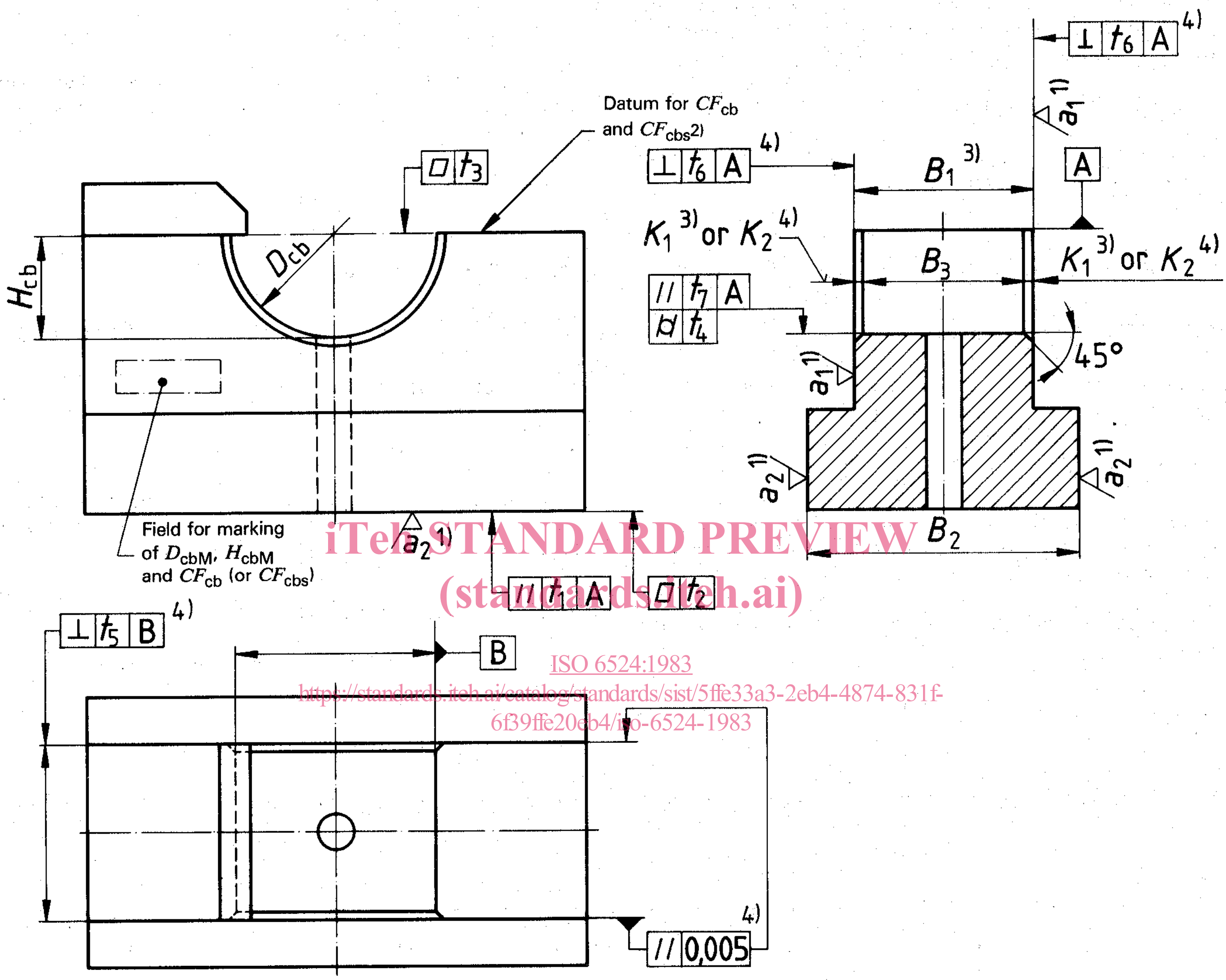

Figure 6 — Checking block

1) It is recommended that the values given in tables 6 and 7 are observed.

2) See 13.1 and 13.2.1.

3) Construction for half bearing without flange :

B_1 may correspond to B_2 or it may be equal to $L_{max} + 3K_{1max}$

with $K_{1max} = 0,4$ mm

4) Construction for flanged half bearing :

B_1, see table 6

$K_2 = h_{max} + 0,5$ mm