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*Incorporating
Corrigendum No. 1*

BRITISH STANDARD

Screw gauge limits and tolerances –

Part 1: Specification for gauges for screw threads of unified form

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Foreword

Publishing information

This British Standard is published by BSI and came into effect on 30 November 2007. It was prepared by Subcommittee SFTSE/1, *Screws and fasteners technical specification committee*, under the authority of Technical Committee TDW/4, *Technical product realization*. A list of organizations represented on these committees can be obtained on request to their secretaries.

BS 919, *Screw gauge limits and tolerances* is in four parts:

Part 1: Specification for gauges for screw threads of unified form

Part 2: Specification for gauges for screw threads of Whitworth and B.A. forms

Part 3: Specification for gauges for screw threads of ISO metric form

Part 4: Limits of size for gauges for screw threads of unified form diameters $\frac{1}{4}$ in and larger

Supersession

This Part of BS 919 supersedes BS 919-1:1960, which is withdrawn.

Relationship with other publications

This British Standard is intended for use with BS 1580, which specifies the corresponding screw threads.

Information about this document

This British Standard has been fully revised to bring it up to date.

The start and finish of text introduced or altered by Corrigendum No. 1 is indicated in the text by tags **[C1]** **[C1]**.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is “shall”.

Commentary, explanation and general informative material is presented in notes in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

1 Scope

This part of BS 919 specifies requirements for the following types of gauges intended for use in the checking of products with unified screw threads for conformity with BS 1580.

- a) Screw gauges:
 - 1) solid screw plug gauges, GO and NOT GO;
 - 2) solid screw ring gauges, GO and NOT GO;
 - 3) adjustable screw ring gauges, GO and NOT GO;
 - 4) adjustable screw calliper gauges GO and NOT GO.
- b) Setting plugs for adjustable ring gauges and for calliper gauges, GO and NOT GO:
 - 1) double length;
 - 2) single length.
- c) Screw check plugs for solid screw ring gauges, GO and NOT GO.
- d) Plug gauges and calliper gauges for the crest diameters of product threads, GO and NOT GO.

Annex A gives information about the various types of gauges covered by BS 919. Annex B explains the conventional method for showing the tolerance zones of gauges. Guidance on the calculation of the effective diameter equivalent of pitch and angle errors is given in Annex C. Annex D recommends a method for gauging screw threads before and after coating. Notes on the setting to size of adjustable screw ring gauges are presented in Annex E, while Annex F presents a comparison of British and American screw thread terminology. Annex G discusses the tolerances for major, effective and minor diameters and flank angle and pitch permitted by BS 1580. Guidance on the hardness of gauges is given in Annex H.

2 Normative references

The latest edition of the following referenced document (including any amendments) is indispensable for the application of this document.

BS 1044-1, *Specification for gauge blanks – Part 1: Plug, ring and calliper gauges*

☐¹ BS 6528:1984, *Glossary of terms for cylindrical screw threads* ☐¹

3 Terms and definitions and symbols

3.1 Terms and definitions

For the purposes of this part of BS 919, the terms and definitions given in BS 6528:1984 and the following apply.

3.1.1 effective diameter

diameter of the pitch cylinder

NOTE 1 This is the “simple” effective diameter, as distinct from the “virtual” effective diameter (see 3.1.2).

NOTE 2 Also known as “pitch diameter”.

3.1.2 virtual effective diameter

effective diameter of an imaginary thread of perfect pitch and flank angle, having the full depth of flanks, but clear at the crests and roots, which would just assemble with the actual thread over the prescribed length of engagement

NOTE The “virtual” effective diameter exceeds the effective diameter in the case of an external thread, but is less than the effective diameter in the case of an internal thread, by an amount corresponding to the combined diametral effects due to any errors in the pitch and/or the flank angles of the thread.

3.2 Symbols

For the purposes of this part of BS 919, the following symbols apply.

NOTE 1 These are repeated from BS 6528 for the convenience of users of this standard.

D	major diameter of internal thread
D_1	minor diameter of internal thread
D_2	effective diameter of internal thread (see Note 2)
d	major diameter of external thread
d_1	minor diameter of external thread
d_2	effective diameter of external thread (see Note 2)
H	height of fundamental triangle
P	pitch

NOTE 2 These are the symbols given for pitch diameter in BS 6528.

4 Design**4.1 General**

The general dimensions of blanks suitable for both screw and plain gauges shall conform to BS 1044-1.

4.2 Feather edges

To avoid feather edges on screw plug and ring gauges and setting plugs, the partial thread at both ends of the gauge shall be removed to a blunt start, except for:

- screw plug gauges and setting plugs in sizes below 0.150 in and/or with external cone centres; and
- screw ring gauges $\frac{1}{2}$ inch nominal size and smaller or with pitches of 20 threads per inch and finer, and all screw plug gauges and setting plugs with pitches of 28 threads per inch and finer for which a 60° chamfer from the axis of the gauge is permitted in lieu of the removal of the partial thread.

Not more than one complete turn of the thread shall be removed to the point where the full thread form is obtained.

On double length setting plugs with pitches of 28 threads per inch and coarser, where the truncated portion meets the full form portion, the feather edge shall be completely removed.

4.3 Dirt clearance grooves

When specified by the user, screw plug gauges shall have a dirt clearance groove cut axial to the thread to a depth slightly below the root of the thread and at the position where the thread commences at its full section, as specified in 4.2.

4.4 Removal of sharp edges

All sharp edges on the gauging portions and handles shall be removed.

5 Tolerances and thread forms

NOTE Since small inaccuracies in size and form of gauges are inevitable in their manufacture, tolerances are specified to control these inaccuracies to a degree which is both practical and economical.

Attention has to be paid to the product tolerance and care taken that the gauge tolerance does not unduly absorb, or add to, the product tolerance, though it is not possible to lay down a hard and fast relationship between gauge tolerance and product tolerance in the case of screw gauges.

Absorption of product tolerance by the gauge tolerance depends upon the position of the gauge tolerance zone in relation to the product tolerance zone. Figure 1 illustrates the relative dispositions of gauge and product tolerance zones, using the conventional methods of showing tolerance zones explained in Annex B.

5.1 Screw plug gauges

The tolerance zones for GO and NOT GO screw gauges shall be as shown in Figure 1.

Tolerances for GO screw plug gauges and for NOT GO effective diameter screw plug gauges shall be as specified in Table 1 and Table 2, respectively.

The form of thread for GO screw plug gauges shall be as shown in Figure 2a).

NOTE Figure 3a) indicates the profile of a gauge which, theoretically, would verify that the thickness of the product thread is not less than half the basic pitch at a diameter equal to the minimum metal limit specified for the effective diameter of the product thread. Such a gauge would not only be difficult to measure but would also wear very quickly in use. The gauge is made practicable, however, by providing it with limited lengths of flank, as shown in Figure 3b). The longer these flanks, the less critical does the gauge become in controlling the effective diameter of the product thread when the flank angles are in error or when other malformations exist. Alternative forms of thread for NOT GO effective diameter screw plug gauges are shown in Figure 4. Figure 4a) shows a short flank (or low addendum) gauge having an addendum of $H/8$, while Figure 4b) shows a long flank (or high addendum) gauge with an addendum of $H/4$.

A long flank NOT GO effective diameter gauge is less effective than a short flank gauge in detecting thin threads when angle errors are present, or when other malformations of the thread exist such as those due to tearing. Guidance on the selection of gauges is given in BS 1580.

The American type high addendum NOT GO effective diameter screw plug gauge should be used for checking the numbered sizes of internal threads.

5.2 Plain plug gauges

The disposition of the tolerance zones for plain plug gauges shall be as shown in Figure 1.

Tolerances for GO and NOT GO plain plug gauges for minor diameters of internal threads shall be as specified in Table 3.

5.3 Screw ring gauges and callipers

The disposition of the tolerance zones for GO and NOT GO screw ring gauges and callipers shall be as shown in Figure 1.

Tolerances for GO screw ring gauges, solid type, and for NOT GO effective diameter screw ring gauges, solid type, shall be as specified in Tables 4 and Table 5, respectively.

Tolerances for GO and NOT GO screw check plugs, and for GO and NOT GO plain check plugs for use in testing GO and NOT GO screw ring gauges, solid type, shall be as specified in Table 6 to Table 11.

Tolerances for adjustable GO and NOT GO screw ring and calliper gauges shall be as specified in Tables 12 and Table 13.

NOTE 1 No tolerances are given in the tables for the effective diameter because calliper gauges and adjustable ring gauges are set to size by means of setting plugs.

The form of thread for GO screw ring gauges, solid and adjustable, and $\boxed{G_1}$ GO $\boxed{C_1}$ calliper gauges shall be as shown in Figure 2b). The form of thread for NOT GO screw ring gauges (solid and adjustable) and NOT GO calliper gauges shall be as shown in Figure 4c).

NOTE 2 This is the same form as that used in the USA for LO ring gauges. See A.2.6, Note.

NOTE 3 Since adjustable ring gauges are set to size on effective diameter by means of setting plugs, no tolerances are shown for the effective diameters of the gauges. Nevertheless, it is important that the ring gauge is lapped or ground to a size similar to that of the setting plug to which it is to be set. See Annex E.

The positions of the tolerance zones for double length and single length setting plugs relative to the tolerance zone for the external thread shall be as shown in Figure 1.

Tolerances for double length setting plugs for use with adjustable GO and NOT GO screw ring gauges shall be as specified in Table 14 and Table 15.

Tolerances for single length setting plugs for use with adjustable GO and NOT GO screw calliper gauges shall be as specified in Table 16 and Table 17.

The form of thread for double length setting plugs for adjustable ring gauges and for single length setting plugs for adjustable calliper gauges shall be as shown in Figure 5.

5.4 Plain calliper gauges

The disposition of the tolerance zones for plain calliper gauges shall be as shown in Figure 1.

Tolerances for GO and NOT GO plain calliper gauges for the major diameters of external threads shall be as specified in Table 18.

Table 1 Tolerances for GO screw plug gauges – all classes

Unit of tolerance for diameters and pitch = in × 0.000 1

1	2	3	4	5	6	7	8	9
Threads per inch	Major diameter (see Note 1)		Effective diameter (see Note 2)				Pitch ^{A)}	Flank angle
	Up to and including 4 in	Above 4 in	Up to and including 1½ in	Above 1½ up to 4 in	Above 4 up to 8 in	Above 8 up to 12 in		
80	+3		+2				1½	Minutes + or –
72	+3		+2				1½	30
64	+4		+2				1½	30
56	+4		+2	+3			1½	30
48	+4		+2	+3			1½	30
44	+4		+2	+3			1½	20
40	+4		+2	+3			1½	20
36 \square_{C1}	+4		+2	+3			1½	20
32	+5	+7	+3	+4	+5	+6	2	15
28	+5	+7	+3	+4	+5	+6	2	15
24	+5	+7	+3	+4	+5	+6	2	15
20	+5	+7	+3	+4	+5	+6	2	15
18	+5	+7	+3	+4	+5	+6	2	10
16	+6	+9	+3	+4	+6	+8	2	10
14	+6	+9	+3	+4	+6	+8	2	10
13	+6	+9	+3	+4	+6	+8	2	10
12	+6	+9	+3	+4	+6	+8	2	10
11	+6	+9	+3	+4	+6	+8	\square_{C1} 2 \square_{C1}	10
10	+6	+9	+3	+4	+6	+8	2	10
9	+7	+11	+3	+4	+6	+8	2	10
8	+7	+11	+4	+5	+6	+8	3	5
7	+7	+11	+4	+5	+6	+8	3	5
6	+8	+13	+4	+5	+6	+8	3	5
5	+8	+13		+5	+6	+8	3	5
4½	+8	+13		+5	+6	+8	3	5
4	+9	+15		+5	+6	+8	3	5

A) Maximum permissible error between any two threads irrespective of sign.

NOTE 1 The limits of size are obtained by applying the tolerance to the minimum major diameter of the internal product.

NOTE 2 The limits of size are obtained by applying the tolerance to the minimum effective diameter of the internal product.

NOTE 3 The minor diameter should be cleared as shown in Figure 2.

NOTE 4 The tolerances in this table are the same in magnitude and direction as the US "X" tolerances for GO screw plug gauges, except for the pitch tolerances.

Table 2 Tolerances for NOT GO screw plug gauges – all classes

Unit of tolerance for diameters and pitch = in × 0.000 1

1	2	3	4	5	6	7	8	9
Threads per inch	Major diameter [C ₁](see Notes 1 to 3)[C ₁]		Effective diameter (see Note 4)				Pitch ^{A)}	Flank angle
	Up to and including 4 in	Above 4 in	Up to and including 1½ in	Above 1½ up to 4 in	Above 4 up to 8 in	Above 8 up to 12 in		
80	-3		+2				1½	Minutes + or - 30
72	-3		+2				1½	30
64	-4		+2				1½	30
56	-4		+2	+3			1½	30
48	-4		+2	+3			1½	30
44	-4		+2	+3			1½	20
40	-4		+2	+3			1½	20
[C ₁] 36 [C ₁]	-4		+2	+3			1½	20
32	-5	-7	+3	+4	+5	+6	2	15
28	-5	-7	+3	+4	+5	+6	2	15
24	-5	-7	+3	+4	+5	+6	2	15
20	-5	-7	+3	+4	+5	+6	2	15
18	-5	-7	+3	+4	+5	+6	2	10
16	-6	-9	+3	+4	+6	+8	2	10
14	-6	-9	+3	+4	+6	+8	2	10
13	-6	-9	+3	+4	+6	+8	2	10
12	-6	-9	+3	+4	+6	+8	2	10
11	-6	-9	+3	+4	+6	+8	2	10
10	-6	-9	+3	+4	+6	+8	2	10
9	-7	-11	+3	+4	+6	+8	2	10
8	-7	-11	+4	+5	+6	+8	3	5
7	-7	-11	+4	+5	+6	+8	3	5
6	-8	-13	+4	+5	+6	+8	3	5
5	-8	-13		+5	+6	+8	3	5
4½	-8	-13		+5	+6	+8	3	5
4	-9	-15		+5	+6	+8	3	5

A) Maximum permissible error between any two threads irrespective of sign.

NOTE 1 The form of thread of the low addendum plug gauge is shown in Figure 4a) and of the high addendum plug gauge in Figure 4b).

NOTE 2 The limits of size of the major diameter of the low addendum gauge are obtained by applying the tolerances to the maximum effective diameter of the internal product plus H/4.

NOTE 3 The limits of size of the major diameter of the high addendum gauge are obtained by applying the tolerance to the maximum effective diameter of the internal product plus H/2, but ought not to exceed the minimum major diameter of the internal thread minus 0.0375H.

NOTE 4 The limits of size of the effective diameter are obtained by applying the tolerance to the maximum effective diameter of the internal product.

NOTE 5 The tolerances in this table are the same in magnitude and direction as the US "X" tolerances for "HI" gauges (plus tolerance), except for the pitch tolerances.

Table 3 Tolerances for GO and NOT GO plain plug gauges for minor diameters

Major diameter of internal product thread		Tolerances on plain diameter
Above	Up to and including	
in	in	in × 0.000 1
	0.1	+2 0
0.1	0.5	+3 0
0.5	1.5	+3 0
1.5	3.0	+4 0
3.0	5.0	+5 0
5.0	8.0	+5 0
8.0	12.0	+6 0

NOTE The limits of size for GO gauges are obtained by applying the limits of tolerance to the minimum minor diameter of the internal thread, and for NOT GO gauges to the maximum minor diameter of the internal thread.

Table 4 Tolerances for GO screw ring gauges – solid type, all classes

Unit = in × 0.000 1

1	2	3	4	5	6	7	8	9	10
Major diameter of external product thread		Effective diameter (see Notes 1 and 3)						Minor diameter (see Note 2)	Major diameter
Above	Up to and including	Any pitch	48-24 t.p.i.	20-13 t.p.i.	12-8 t.p.i.	7 and 6 t.p.i.	5-4 t.p.i.		
in	in	-5						-5	Cleared as shown in Figure 2
	0.1		-6	-6	-7			-6	
0.1	0.5		-7	-8	-8	-8		-7	
0.5	1.5		-8	-8	-9	-9	-10	-8	
1.5	3.0			-9	-10	-11	-12	-9	
3.0	5.0			-10	-11	-12	-12	-10	
5.0	8.0				-12	-12	-13	-12	
8.0	12.0								

NOTE 1 The limits of size are obtained by applying the tolerance to the maximum effective diameter of the external product.

NOTE 2 The limits of size are obtained by applying the tolerance to the minimum minor diameter of the internal thread, minus the product allowance (when specified).

NOTE 3 Both the effective diameter and the virtual effective diameter, i.e. the effective diameter as reduced by the effective diameter equivalent of pitch and angle errors, should lie within the limits of size specified above.

Table 5 Tolerances for NOT GO effective diameter screw ring gauges – solid type, all classes

Unit = in × 0.000 1

1	2	3	4	5	6	7	8	9	10
Major diameter of external product thread		Effective diameter (see Notes 1 and 3)						Minor diameter (see Note 2)	Major diameter
Above	Up to and including	Any pitch	48-24 t.p.i.	20-13 t.p.i.	12-8 t.p.i.	7 and 6 t.p.i.	5-4 t.p.i.		
in	in	-4						+5	Cleared as shown in Figure 4c)
0.1	0.5		-5	-5	-5			+6	
0.5	1.5		-5	-6	-6	-6		+7	
1.5	3.0		-6	-6	-7	-7	-8	+8	
3.0	5.0			-7	-8	-8	-9	+9	
5.0	8.0			-8	-8	-9	-9	+10	
8.0	12.0				-9	-9	-10	+12	

NOTE 1 The limits of size are obtained by applying the tolerance to the minimum effective diameter of the external product.

NOTE 2 The limits of size are obtained by applying the tolerance to the minimum $\boxed{C_1}$ effective $\langle C_1 \rangle$ diameter of the external product minus $H/4$.

NOTE 3 Both the effective diameter and the virtual effective diameter should lie within the limits of size specified above.

Table 6 Tolerances for GO screw check plugs for GO screw ring gauges – solid type

Unit = in × 0.000 1

1	2	3	4	5
Major diameter of external product thread		Effective diameter (see Notes 1 and 2)	Major diameter (see Note 3)	Minor diameter
Above	Up to and including	All pitches		
in	in			Cleared as shown in Figure 2a)
	0.5	-3	-3	
0.5	1.5	-4	-4	
1.5	3.0	-5	-5	

NOTE 1 The limits of size of the effective diameter are obtained by applying the tolerance to the minimum effective diameter of the GO screw ring gauge (see Table 4).

NOTE 2 Both the effective diameter and the virtual effective diameter should be within the limits of size specified above.

NOTE 3 The limits of size of the major diameter are obtained by applying the tolerance to the minimum effective diameter of the GO screw ring gauge plus $3H/4$.

Table 7 Tolerances for NOT GO effective diameter check plugs for new GO screw ring gauges – solid type

Unit = in × 0.000 1

1	2	3	4	5
Major diameter of external product thread		Effective diameter (see Notes 1 and 2)	Major diameter (see Note 3)	Minor diameter
Above	Up to and including	All pitches		
in	in			Cleared as shown in Figure 4a)
	0.5	+2	–3	
0.5	1.5	+3	–4	
1.5	3.0	+4	–5	

NOTE 1 The limits of size of the effective diameter are obtained by applying the tolerance to the maximum effective diameter of the GO ring gauge (i.e. maximum effective diameter of external product).

NOTE 2 Both the effective diameter and the virtual effective diameter should be within the limits of size specified above.

NOTE 3 The limits of size of the major diameter are obtained by applying the tolerance to the maximum effective diameter of the external product plus $H/4$.

Table 8 Tolerances for NOT GO effective diameter check plugs for worn GO ring screw gauges – solid type

Unit = in × 0.000 1

1	2	3	4	5
Major diameter of external product thread		Effective diameter (see Notes 1 and 2)	Major diameter (see Note 3)	Minor diameter
Above	Up to and including	All pitches		
in	in			Cleared as shown in Figure 4a)
	0.5	+2	0	
		+4	–3	
0.5	1.5	+3	0	
		+6	–4	
1.5	3.0	+4	0	
		+8	–5	

NOTE 1 The limits of size of the effective diameter are obtained by applying the limits of tolerance to the maximum effective diameter of the GO ring gauge (i.e. maximum effective diameter external product).

NOTE 2 Both the effective diameter and the virtual effective diameter should be within the limits of size specified above.

NOTE 3 The limits of size of the major diameter are obtained by applying the limits of tolerance to the maximum effective diameter of the external product plus $H/4$.

Table 9 Tolerances for GO screw check plugs for NOT GO effective diameter ring gauges – solid type

Unit = in × 0.000 1

1	2	3	4	5
Major diameter of external product thread		Effective diameter (see Notes 1 and 2)	Major diameter (see Note 3)	Minor diameter
Above	Up to and including	All pitches		
in	in			Cleared as shown in Figure 2a)
	0.5	−3	+3	
0.5	1.5	−4	+4	
1.5	3.0	−5	+5	

NOTE 1 The limits of size of the effective diameter are obtained by applying the tolerance to the minimum effective diameter of the NOT GO screw ring gauge (see Table 5).

NOTE 2 Both the effective diameter and the virtual effective diameter should be within the limits of size specified above.

NOTE 3 The limits of size for the major diameter of GO screw check plugs are obtained in the following way. The maximum limit is the smallest of the values obtained from the following three formulae:

- maximum effective diameter of external thread $+3H/4$ + major diameter tolerance of check plug;
- minimum effective diameter of external thread $+3P/4$ + major diameter tolerance of check plug;
- minimum effective diameter of external thread $+H - 0.001\ 73$.

The minimum limit is obtained by subtracting the major diameter tolerance from the maximum limit.

Table 10 Tolerances for NOT GO screw check plugs for NOT GO effective diameter ring gauges – solid type

Unit = in × 0.000 1

1	2	3	4	5
Major diameter of external product thread		Effective diameter (see Notes 1 and 2)	Major diameter (see Note 3)	Minor diameter
Above	Up to and including	All pitches		
in	in			Cleared as shown in Figure 2a)
	0.5	+2	−3	
0.5	1.5	+3	−4	
1.5	3.0	+4	−5	

NOTE 1 The limits of size of the effective diameter are obtained by applying the tolerance to the minimum effective diameter of the external product.

NOTE 2 Both the effective diameter and the virtual diameter should be within the limits of size specified above.

NOTE 3 The limits of size of the major diameter are obtained by applying the tolerance to the minimum effective diameter of the external product plus $H/4$.

Table 11 Tolerances for GO and NOT GO plain check plugs for the minor diameters of GO and NOT GO screw ring gauges – solid type

Unit = in × 0.000 1

Major diameter of external product thread		Tolerance for GO check plug	Tolerance for NOT GO check plug
Above	Up to and including		
in	in		
	0.5	−1	+1
0.5	1.5	−1	+1
1.5	3.0	−2	+2

NOTE The limits of size for the GO check plug are obtained by applying the tolerance to the minimum minor diameter of the ring gauge and those for the NOT GO check plug are obtained by applying the tolerance to the maximum minor diameter of the ring gauge (Table 4 or Table 5).

Table 12 Tolerances for adjustable GO screw ring and calliper gauges for all classes

Unit = in × 0.000 1

1	2	3	4	5	6
Threads per inch	Minor diameter (see Note 1)		Effective diameter	Pitch ^{A)}	Flank angle
	Up to and including 4 in	Above 4 in			
80	-3			1½	Minutes + or - 30
72	-3			1½	30
64	-4			1½	30
56	-4			1½	30
48	-4			1½	30
44	-4			1½	20
40	-4			1½	20
36	-4			1½	20
32	-5	-7		2	15
28	-5	-7	Since adjustable ring and calliper gauges are set to size on effective diameter by means of setting plugs, as specified in Table 14 and Table 16, no tolerances are given for the effective diameter of the gauges. See Annex E.	2	15
24	-5	-7		2	15
20	-5	-7		2	15
18	-5	-7		2	10
16	-6	-9		2	10
14	-6	-9		2	10
13	-6	-9		2	10
12	-6	-9		2	10
11	-6	-9		2	10
10	-6	-9		2	10
9	-7	-11		2	10
8	-7	-11		3	5
7	-7	-11		3	5
6	-8	-13		3	5
5	-8	-13	3	5	
4½	-8	-13	3	5	
4	-9	-15	3	5	

A) Maximum permissible error between any two threads irrespective of sign.

NOTE 1 The limits of size for the minor diameter are obtained by applying the tolerance to the minimum minor diameter of the internal thread, minus the product allowance (when specified).

NOTE 2 The major diameter should be cleared as shown in Figure 2.

NOTE 3 The tolerances in this table are the same in magnitude and direction as the US "X" tolerances for GO screw ring gauges, except for the pitch tolerances.

Table 13 Tolerances for adjustable NOT GO screw ring and calliper gauges for all classes

Unit = in × 0.000 1

1 Threads per inch	2 Minor diameter (see Note 1)		4 Effective diameter	5 Pitch ^{A)}		6 Flank angle
	Up to and including 4 in	Above 4 in		Ring	Calliper (see Note 2)	
80	+3		Since adjustable ring and calliper gauges are set to size on effective diameter by means of setting plugs, as specified in Table 15 and Table 17, no tolerances are given for the effective diameter of the gauges. See Annex E.	1½	1	Minutes + or – 30
72	+3			1½	1	30
64	+4			1½	1	30
56	+4			1½	1	30
48	+4			1½	1	30
44	+4			1½	1	20
40	+4			1½	1	20
36 $\langle C_1 \rangle$	+4			1½	1	20
32	+5	+7		2	1	15
28	+5	+7		2	1	15
24	+5	+7		2	1	15
20	+5	+7		2	1	15
18	+5	+7		2	1	10
16	+6	+9		2	1	10
14	+6	+9		2	1	10
13	+6	+9		2	1	10
12	+6	+9		2	1	10
11	+6	+9		2	1	10
10	+6	+9		2	1	10
9	+7	+11		2	1	10
8	+7	+11		3	1½	5
7	+7	+11		3	1½	5
6	+8	+13		3	1½	5
5	+8	+13		3	1½	5
4½	+8	+13		3	1½	5
4	+9	+15		3	1½	5

^{A)} Maximum permissible error between *any* two threads irrespective of sign.

NOTE 1 The limits of size for the minor diameter are obtained by applying the tolerance to the minimum effective diameter of the external product minus $H/4$, but ought not to be less than the minimum minor diameter of the GO ring gauge plus $0.0375H$.

NOTE 2 The pitch tolerances are smaller for calliper gauges since the length of thread is limited to 3 pitches.

NOTE 3 The tolerances for ring gauges in this table are the same in magnitude as the US "X" tolerances for "LO" gauges, except for the pitch tolerances.

Table 15 Tolerances for double length setting plugs for adjustable NOT GO screw ring gauges

Unit = in × 0.000 1

1 Threads per inch	2 Major diameter		3 Major diameter Full flank portion (see Note 1)		4 Major diameter Full flank portion (see Note 1)		5 Major diameter Truncated portion (see Note 2)		6 Major diameter Truncated portion (see Note 2)		7 Major diameter Over 4 in Over 4 in		8 Effective diameter (see Note 3)		9 Effective diameter (see Note 3)		10 Effective diameter (see Note 3)		11 Effective diameter (see Note 3)		12 Effective diameter (see Note 3)		13 Pitch ^{A)}		14 Pitch ^{A)}		15 Flank angle	
	Up to and including ½ in	+3	Up to and including ½ in	+3	Up to and including ½ in	+3	Up to and including ½ in	-3	Up to and including ½ in	-3	Up to and including ½ in	-3	Up to and including ½ in	-1	Up to and including ½ in	-1	Up to and including ½ in	-1	Up to and including ½ in	-1	Up to and including ½ in	-1	Up to and including ½ in	Up to and including ½ in	Up to and including ½ in	Above ½ in	Above ½ in	Minutes + or -
80	+3	+3	+3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1 ½	20	
72	+3	+3	+3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1 ½	20	
64	+3	+3	+3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1 ½	20	
56	+3	+3	+3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1 ½	20	
48	+3	+3	+3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1 ½	18	
44	+3	+3	+3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1 ½	15	
40	+3	+3	+3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1 ½	15	
36	+3	+3	+3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1 ½	12	
32	+3	+3	+3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1 ½	12	
28	+5	+5	+5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1 ½	8	
24	+5	+5	+5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1 ½	8	
20	+5	+5	+5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1 ½	8	
18	+5	+5	+5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1 ½	8	
16	+6	+6	+6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1 ½	8	
14	+6	+6	+6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	2	6	
13	+6	+6	+6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	2	6	
12	+6	+6	+6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	2	6	
11	+6	+6	+6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	2	6	
10	+6	+6	+6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	2 ½	6	
9	+7	+7	+7	-7	-7	-7	-7	-7	-7	-7	-7	-7	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	2 ½	6	
8	+7	+7	+7	-7	-7	-7	-7	-7	-7	-7	-7	-7	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	2 ½	5	
7	+7	+7	+7	-7	-7	-7	-7	-7	-7	-7	-7	-7	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	3	5	
6	+8	+8	+8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	3	5	
5	+8	+8	+8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	3	4	
4 ½	+8	+8	+8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	3	4	
4	+9	+9	+9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	3	4	

A) Maximum permissible error between any two threads, irrespective of sign, on either \square portion \square and not further apart than half the overall length of thread.

NOTE 1 The limits of size are obtained by applying the tolerance to the maximum major diameter of the external products. Take the smallest of the values obtained from the following three formulae.

a) Maximum effective diameter of external thread $+3H/4 + \text{major diameter tolerance of GO screw plug gauge}$.

b) Minimum effective diameter of external thread $+3P/4 + \text{major diameter tolerance of GO screw plug gauge}$.

c) Minimum effective diameter of external thread $+H - 0.001 73$.

Subtract the major diameter tolerance of the GO screw plug gauge (Table 1, Columns 2 and 3) from this smallest value to obtain the minimum major diameter limit for the setting plug. Add the major diameter tolerance of the setting plug (Table 15 \square , Columns 2, 3 and 4) to the minimum major diameter limit to obtain the maximum major diameter limits.

NOTE 2 The limits of size are obtained by applying the tolerance to the minimum effective diameter of the external thread.

NOTE 3 The limits of size are obtained by applying the tolerance to the maximum effective diameter of the external thread.

NOTE 4 The minor diameter shall be cleared as shown in Figure 5b).

NOTE 5 The tolerances in this table are the same in magnitude and direction as the US "W" tolerances for truncated (double length) setting plugs.

Table 16 Tolerances for single length setting plugs for adjustable GO screw calliper gauges

Unit = in × 0.000 1

1	2	3	4	5	6	7	8	9	10
Major diameter of product thread		Major diameter (see Note 1)	Effective diameter (see Note 2)						Effective diameter equivalent of pitch and angle errors
Above	Up to and including		Any pitch	48-24 t.p.i.	20-13 t.p.i.	12-8 t.p.i.	7 and 6 t.p.i.	5-4 t.p.i.	
in	in	-10	-3 -5						2
0.1	0.5	-10		-4 -6	-4 -6	-5 -7			3
0.5	1.5	-10		-5 -7	-6 -8	-6 -8	C_1 -6 -8 C_1		3
1.5	3.0	-10		-5 -8	-5 -8	-6 -9	-6 -9	-7 -10	4
3.0	5.0	-10			-5 -9	-6 -10	-7 -11	-8 -12	5
5.0	8.0	-10			-6 -10	-7 -11	-8 -12	-8 -12	5
8.0	12.0	-10				-7 -12	-7 -12	-8 -13	6

NOTE 1 The limits of size are obtained by applying the tolerance to the maximum major diameter of the external product, minus 0.2P.

NOTE 2 The limits of size are obtained by applying the limits of tolerance to the maximum effective diameter of the external product.

NOTE 3 The minor diameter should be cleared as shown in Figure 5c).

Table 17 Tolerances for single length setting plugs for adjustable NOT GO screw calliper gauges

Unit = in × 0.000 1

1	2	3	4	5	6	7	8	9	10
Major diameter of product thread		Major diameter (see Note 1)	Effective diameter (see Note 2)						Effective diameter equivalent of pitch and angle errors
Above	Up to and including		Any pitch	48-24 t.p.i.	20-13 t.p.i.	12-8 t.p.i.	7 and 6 t.p.i.	5-4 t.p.i.	
in	in	-10	-2 -4						2
0.1	0.5	-10		-3 -5	-3 -5	-3 -5			2
0.5	1.5	-10		-3 -5	-4 -6	-4 -6	-4 -6		2
1.5	3.0	-10		-3 -6	-3 -6	-4 -7	-4 -7	-5 -8	3
3.0	5.0	-10			-3 -7	-4 -8	-4 -8	-5 -9	3
5.0	8.0	-10			-4 -8	-4 -8	-5 -9	-5 -9	4
8.0	12.0	-10				-4 -9	-4 -9	-5 -10	4

NOTE 1 The limits of size are obtained by applying the tolerance to the maximum major diameter of the external product, minus 0.2P.

NOTE 2 The limits of size are obtained by applying the limits of tolerance to the minimum effective diameter of the external product.

NOTE 3 The minor diameter should be cleared as shown in Figure 5d).

Table 18 Tolerances for GO and NOT GO plain calliper (GAP) gauges for major diameters

Major diameter of external product thread		Tolerances on width of gap
Above	Up to and including	
in	in	$\text{in} \times 0.000\ 1$
	0.1	0 -2
0.1	0.5	0 -3
0.5	1.5	0 -3
1.5	3.0	0 -4
3.0	5.0	0 -5
5.0	8.0	0 -5
8.0	12.0	0 -6

NOTE The limits of size for the GO gauge are obtained by applying the limits of tolerance to the maximum major diameter of the external thread, and for the NOT GO gauge to the minimum major diameter of the external thread.

Table 19 Constants for use in calculating gauge dimensions (inch)

1	2	3	4	5	6	7	8	9	10	11	12
Threads per inch	Pitch P	$P \frac{3}{4} = 0.75P$	$P/4 = 0.25P$	$P/8 = 0.125P$	0.067P	Height of sharp V-thread $H = 0.866\ 03P$	$\sqrt[3]{E} \frac{3}{4} H = 0.649\ 52P$ $\sqrt[3]{E}$	$H/2 = 0.433\ 01P$	$H/4 = 0.216\ 51P$	$0.037\ 5H = 0.032\ 48P$	$0.060\ \sqrt[3]{P^2} + 0.017P$
80	0.012 50	0.009 38	0.003 12	0.001 56	0.000 84	0.010 83	0.008 12	0.005 41	0.002 71	0.000 41	0.003 4
72	0.013 89	0.010 42	0.003 47	0.001 74	0.000 93	0.012 03	0.009 02	0.006 01	0.003 01	0.000 45	0.003 7
$\sqrt[3]{E}$ 64 $\sqrt[3]{E}$	0.015 63	0.011 72	0.003 91	0.001 95	0.001 05	0.013 53	0.010 15	0.006 77	0.003 38	0.000 51	0.004 0
56	0.017 86	0.013 39	0.004 46	0.002 23	0.001 20	0.015 46	0.011 60	0.007 73	0.003 87	0.000 58	0.004 4
48	0.020 83	0.015 62	0.005 21	0.002 60	0.001 40	0.018 04	0.013 53	0.009 02	0.004 51	0.000 68	0.004 9
44	$\sqrt[3]{E}$ 0.022 73 $\sqrt[3]{E}$	0.017 05	0.005 68	0.002 84	0.001 52	0.019 68	0.014 76	0.009 84	0.004 92	0.000 74	0.005 2
40	0.025 00	0.018 75	0.006 25	0.003 12	0.001 68	0.021 65	0.016 24	0.010 83	0.005 41	0.000 81	0.005 6
36	0.027 78	0.020 83	0.006 94	0.003 47	0.001 86	0.024 06	0.018 04	0.012 03	0.006 01	0.000 90	0.006 0
32	0.031 25	0.023 44	0.007 81	0.003 91	0.002 09	0.027 06	0.020 30	0.013 53	0.006 77	0.001 01	0.006 5
28	0.035 71	0.026 79	0.008 93	0.004 46	0.002 39	0.030 93	0.023 20	0.015 46	0.007 73	0.001 16	0.007 1
24	0.041 67	0.031 25	0.010 42	0.005 21	0.002 79	0.036 08	0.027 06	0.018 04	0.009 02	0.001 35	0.007 9
20	0.050 00	0.037 50	0.012 50	0.006 25	0.003 35	0.043 30	0.032 48	0.021 65	0.010 83	0.001 62	0.009 0
18	0.055 56	0.041 67	0.013 89	0.006 94	0.003 72	0.048 11	0.036 08	0.024 06	0.012 03	0.001 80	0.009 7
16	0.062 50	0.046 88	0.015 62	0.007 81	0.004 19	0.054 13	0.040 59	0.027 06	0.013 53	0.002 03	0.010 5
14	0.071 43	0.053 57	0.017 86	0.008 93	0.004 79	0.061 86	0.046 39	0.030 93	0.015 46	0.002 32	0.011 5
13	0.076 92	0.057 69	0.019 23	0.009 62	0.005 15	0.066 62	0.049 96	0.033 31	0.016 65	0.002 50	0.012 2
12	0.083 33	0.062 50	0.020 83	0.010 42	0.005 58	0.072 17	0.054 13	0.036 08	0.018 04	0.002 71	0.012 9
11	0.090 91	0.068 18	0.022 73	0.011 36	0.006 09	0.078 73	0.059 05	0.039 36	0.019 68	0.002 95	0.013 7
10	0.100 00	0.075 00	0.025 00	0.012 50	0.006 70	0.086 60	0.064 95	0.043 30	0.021 65	0.003 25	0.014 6
9	0.111 11	0.083 33	0.027 78	0.013 89	0.007 44	0.096 23	0.072 17	0.048 11	0.024 06	0.003 61	0.015 8
8	0.125 00	0.093 75	0.031 25	0.015 62	0.008 38	0.108 25	0.081 19	0.054 13	0.027 06	0.004 06	0.017 1
7	0.142 86	0.107 14	0.035 71	0.017 86	0.009 57	0.123 72	0.092 79	0.061 86	0.030 93	0.004 64	0.018 8
6	0.166 67	0.125 00	0.041 67	0.020 83	0.011 17	0.144 34	0.108 25	0.072 17	0.036 08	0.005 41	0.021 0
5	0.200 00	0.150 00	0.050 00	0.025 00	0.013 40	0.173 21	0.129 90	0.086 60	0.043 30	0.006 50	0.023 9
4½	0.222 22	$\sqrt[3]{E}$ 0.166 67 $\sqrt[3]{E}$	0.055 56	0.027 78	0.014 89	0.192 45	0.144 34	0.096 23	0.048 11	0.007 22	0.025 8
4	0.250 00	0.187 50	0.062 50	0.031 25	0.016 75	0.216 51	0.162 38	0.108 25	0.054 13	0.008 12	0.028 1

Figure 1 Disposition of effective diameter tolerance zones for screw gauges

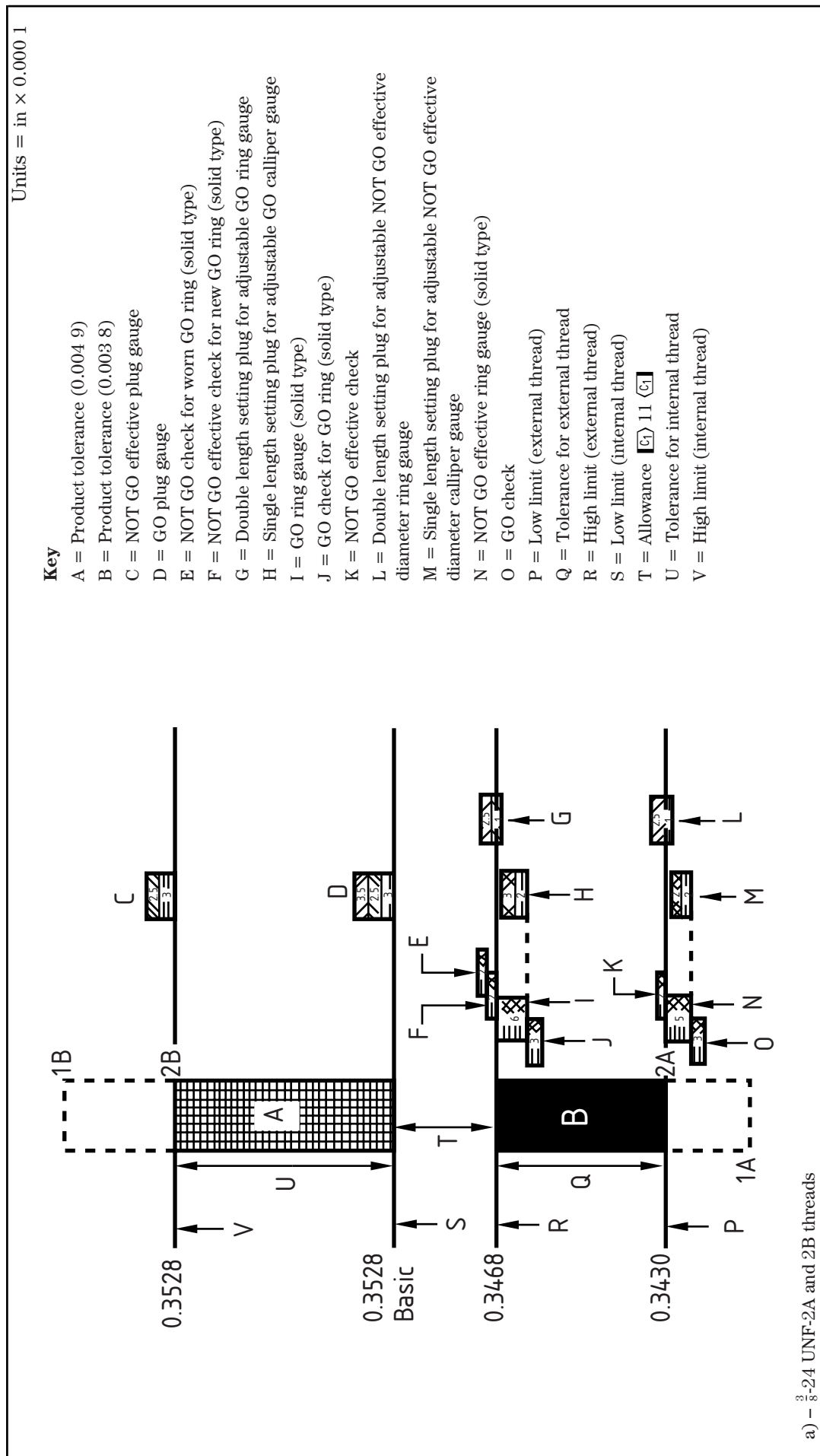


Figure 1 Disposition of effective diameter tolerance zones for screw gauges (continued)

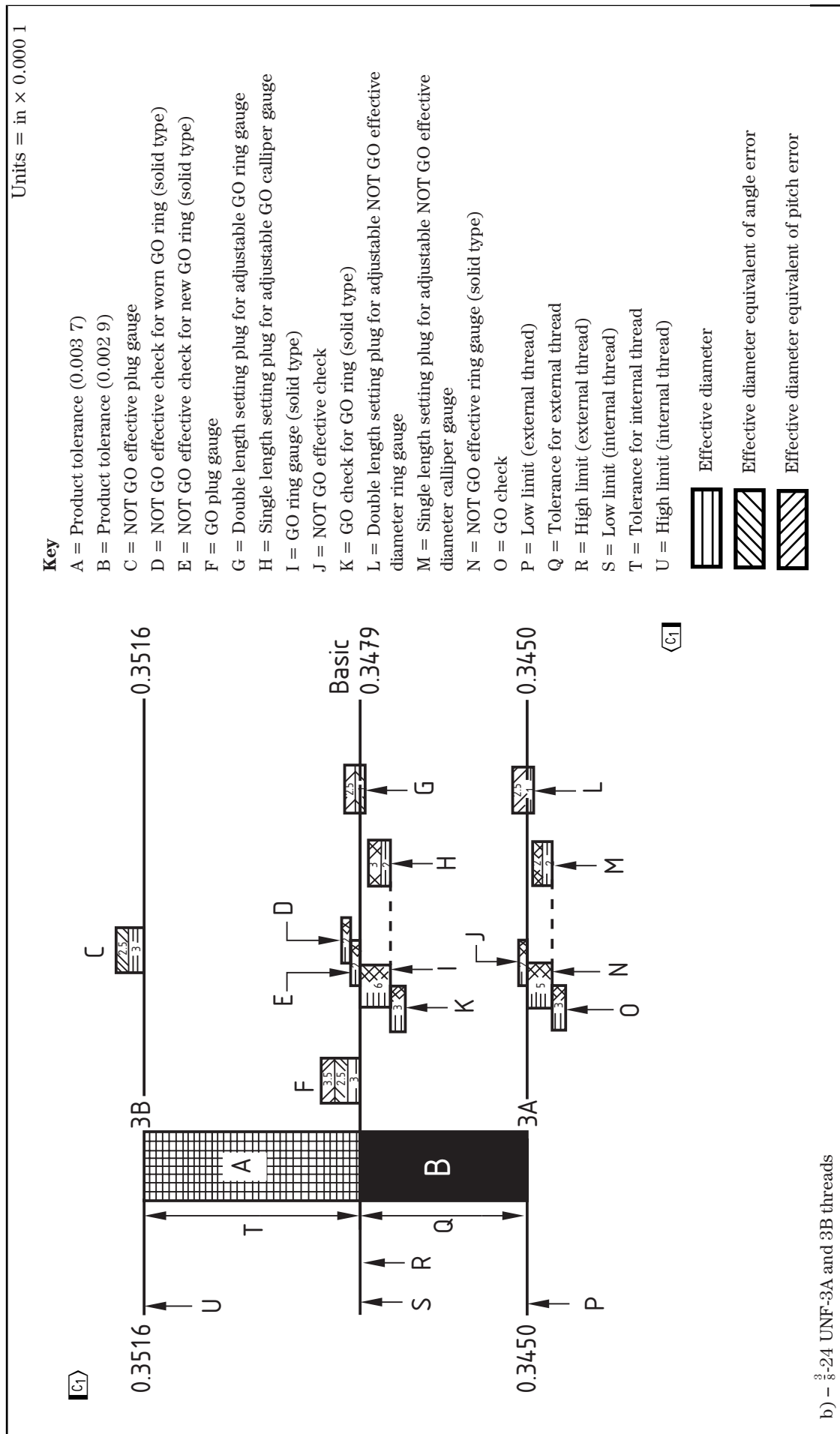


Figure 2 Thread forms of GO gauges

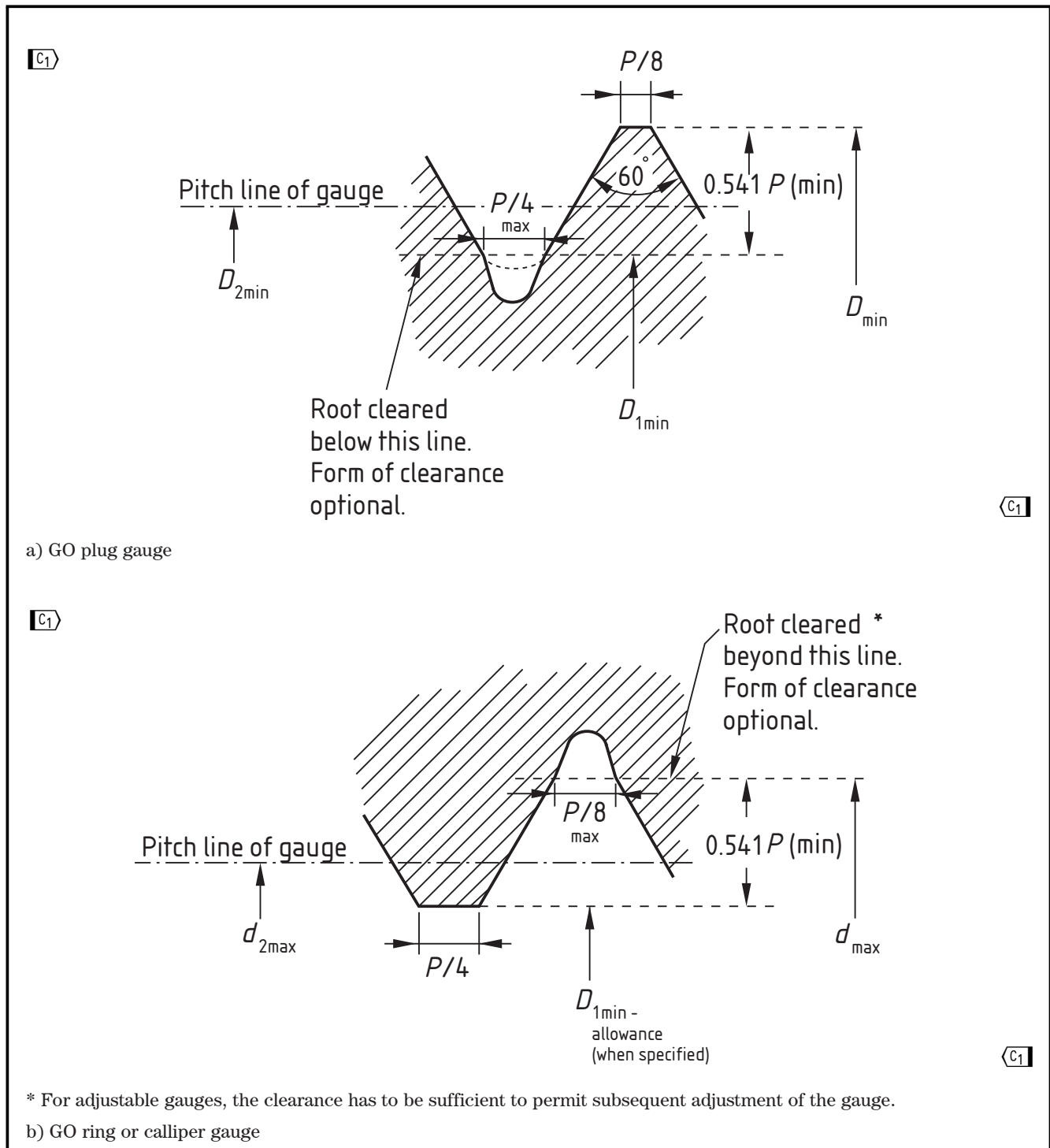


Figure 3 Thread forms of NOT GO gauges

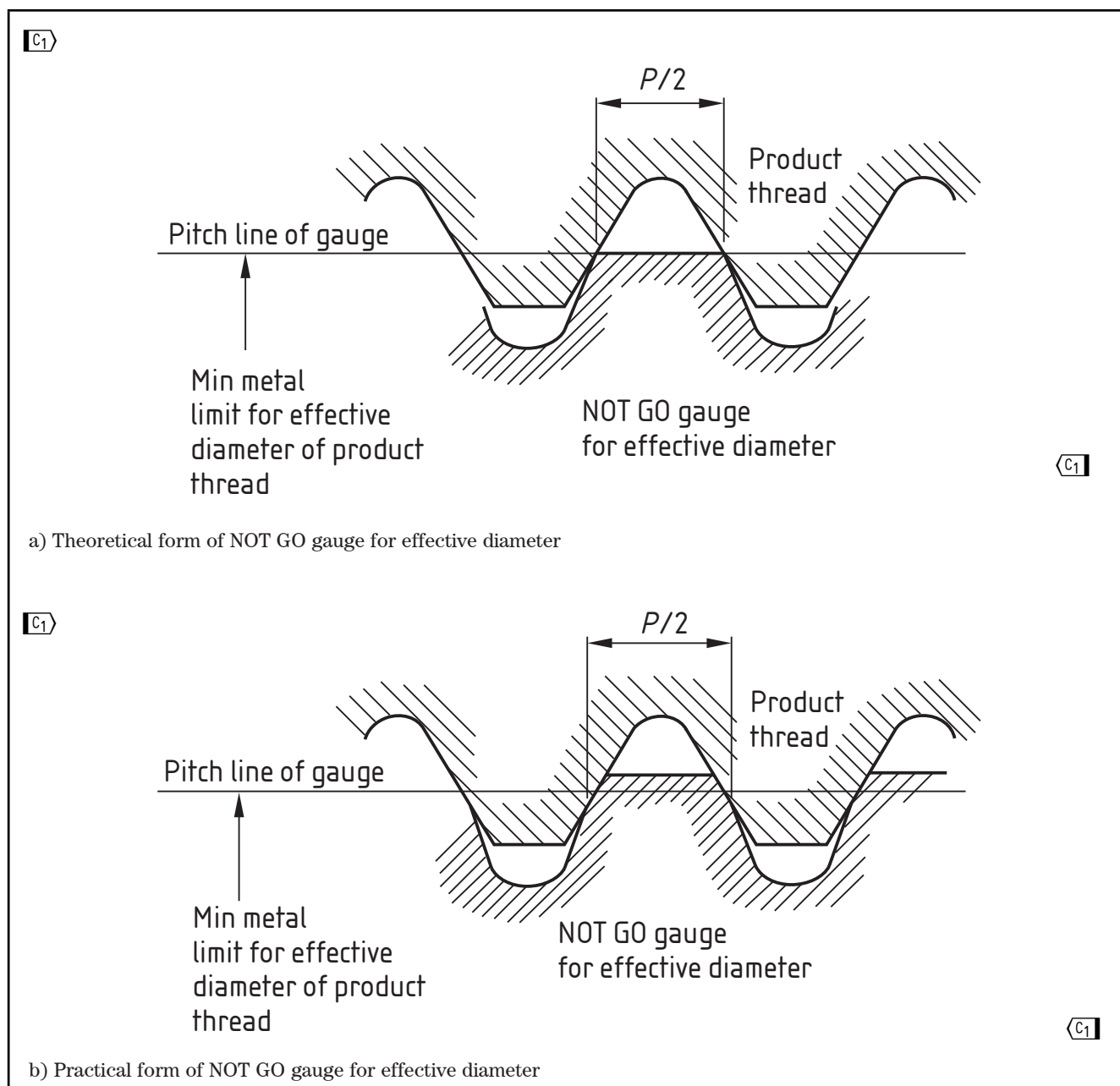


Figure 4 Forms of thread for NOT GO effective diameter screw gauges

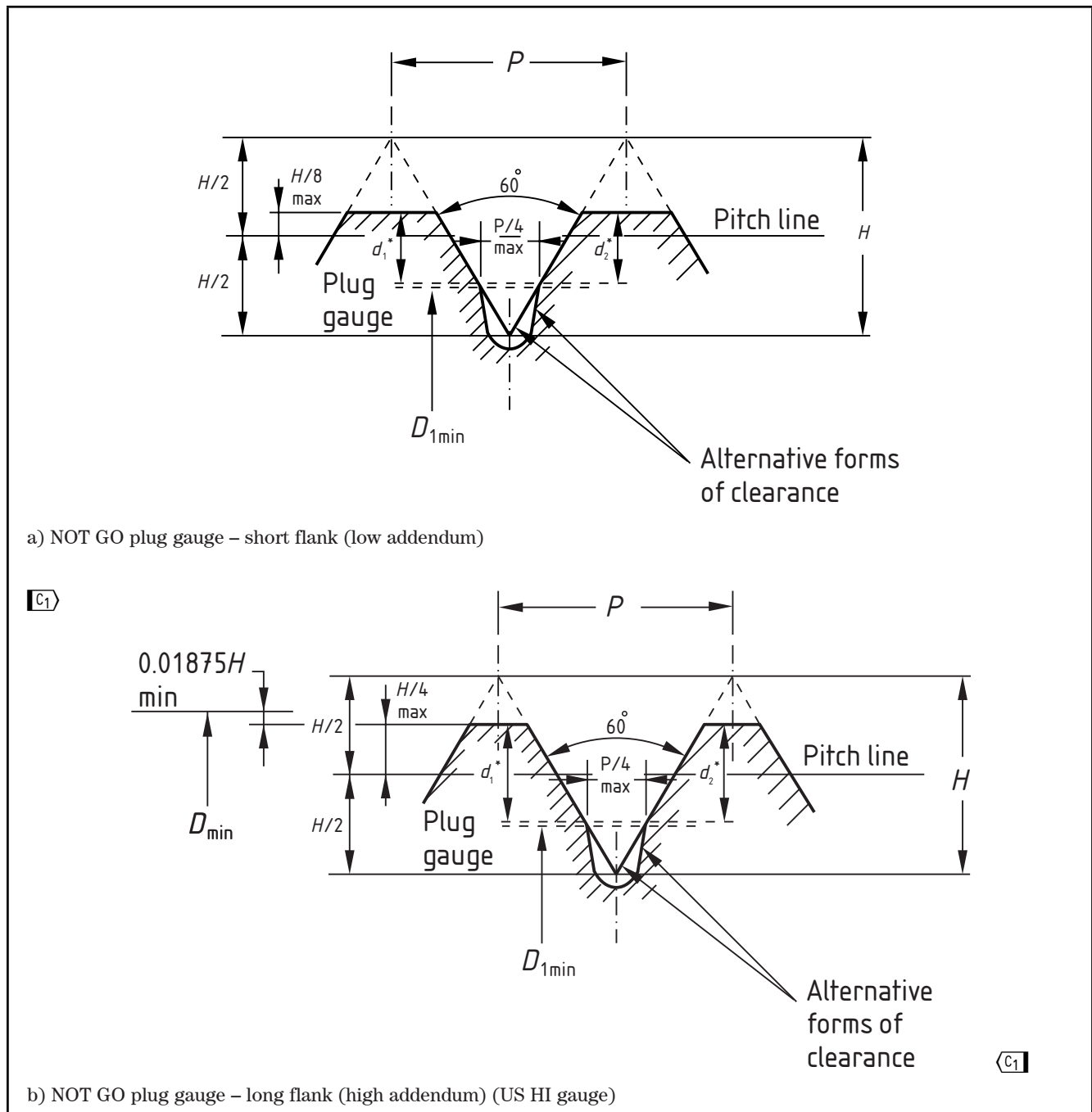


Figure 4 Forms of thread for NOT GO effective diameter screw gauges
(continued)

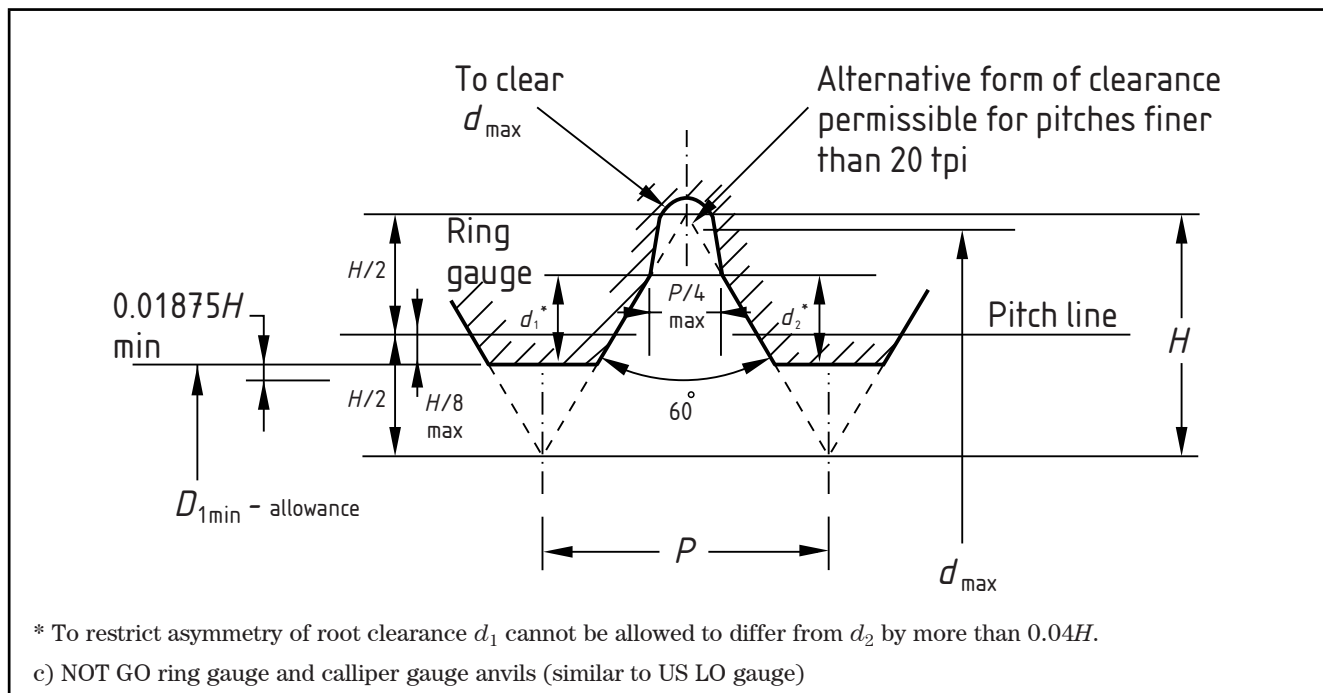
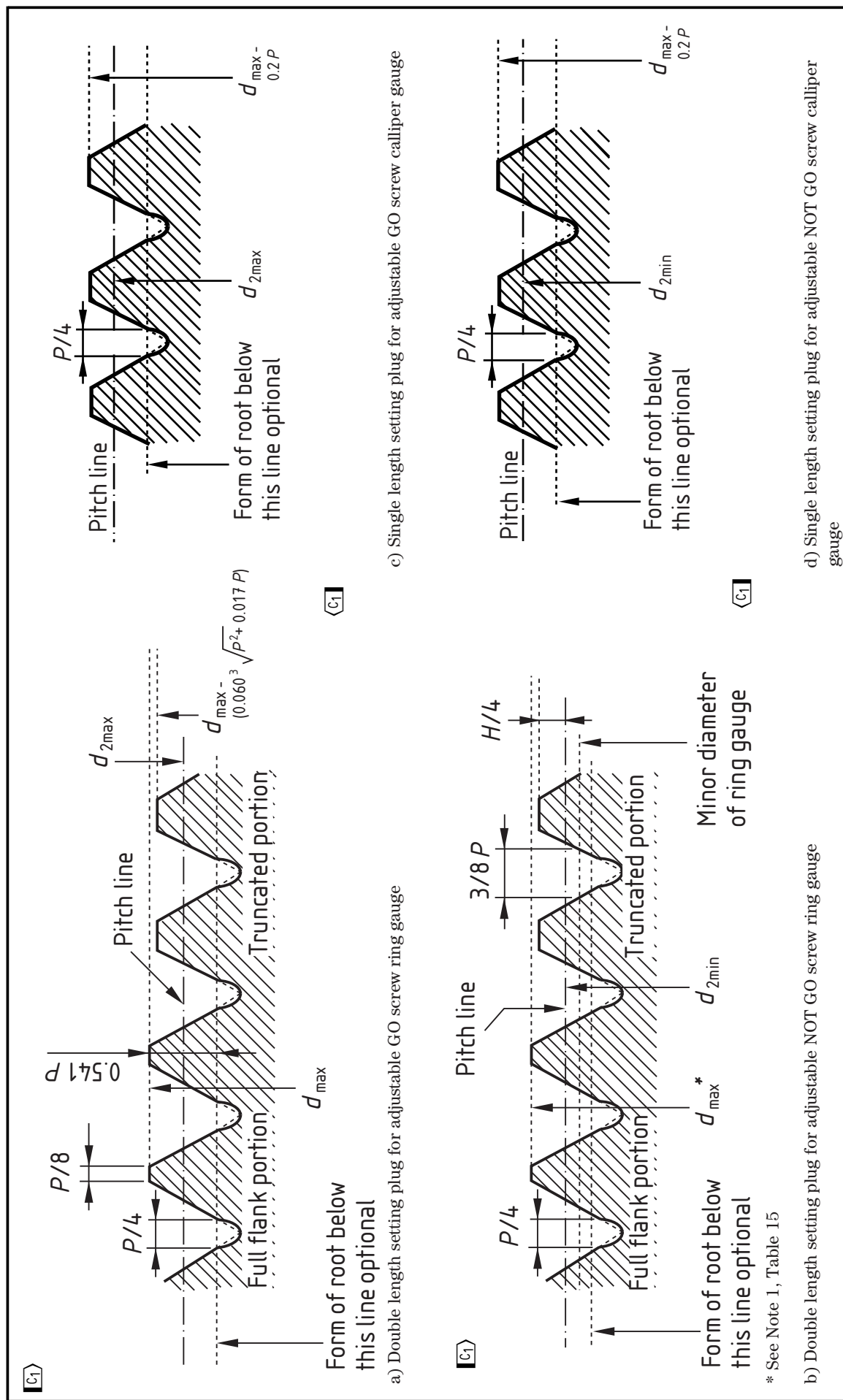


Figure 5 Thread forms of setting plugs



6 Marking

Each gauge shall be plainly and permanently marked with the minimum marking essential for positive identification. In the case of plug gauges of the renewable-end type, in addition to appearing on the handle, the marking shall also appear on the end-face of the gauging member or, where this is not practicable, on its taper shank.

Unless otherwise specified by the purchaser the following particulars shall be included in the marking.

- a) The designation of the corresponding product thread in accordance with BS 1580.

NOTE 1 In the case of left-hand screw gauges, the symbol L.H. follows the designation.

NOTE 2 When the corresponding product thread is coated, the gauges might have to be marked BEF COAT or AFT COAT as appropriate, but care should be taken to avoid unnecessary duplication of gauges (see Annex D).

- b) The size of the gauge, i.e. the limiting dimension of the product thread which the gauge is intended to control.

NOTE For screw gauges, the marked size should be the maximum or minimum effective diameter limit of the product thread, as appropriate.

- c) GO or NOT GO, as applicable.
- d) HI.ADD in the case of NOT GO plug screw gauges with high addendum.
- e) SET PLUG in the case of setting plugs for adjustable screw ring or calliper gauges.
- f) CHK PLUG in the case of check plugs for solid screw ring gauges.
- g) The manufacturer's name or trade mark.
- h) A serial number if required for recording purposes.

Examples of marking for gauges

Class of gauge	Marking
GO screw plug	$\frac{1}{4}$ -20 UNC 2B, GO, EFF 0.2175, X Co. No. 27
NOT GO screw plug (with low addendum)	$\frac{1}{4}$ -20 UNC 2B, NOT GO, EFF 0.2223, X Co. No. 4
NOT GO screw plug (with high addendum)	$\frac{1}{4}$ -20 UNC 2B, NOT GO, EFF 0.2223, HI.ADD, X Co. No. 6
Plain plug for minor diameter	$\frac{1}{4}$ -20 UNC 2B, GO, 0.1959, X Co. No. 7
	$\frac{1}{4}$ -20 UNC 2B, NOT GO, 0.2067, X Co. No. 17
GO screw ring or calliper	$\frac{1}{4}$ -20 UNC 2A, GO, EFF 0.2164, X Co. No. 22
NOT GO thread calliper gauge	$\frac{1}{4}$ -20 UNC 2A, NOT GO, EFF 0.2127, X Co. No. 61
Plain calliper for major diameter	$\frac{1}{4}$ -20 UNC 2A, GO, 0.2500, X Co. No. 75
	$\frac{1}{4}$ -20 UNC 2A, NOT GO, 0.2408, X Co. No. 57

Annex A (informative) Verifying conformity with BS 1580**A.1 Methods of inspection**

There are two ways of verifying that product screw threads conform to BS 1580:

- a) by the use of screw thread gauges, which is the usual way of inspecting threads, especially when large quantities of the product are involved (see **A.2** to **A.6**); and
- b) where small quantities of threaded components are involved so that the use of gauges is uneconomical, by direct measurement of the thread elements; specifically, the diameters, pitch and flank angles (see **A.3** and “*Notes on Applied Science No. 1 — Gauging and measuring screw threads*” [1]).

A.2 Inspection by screw thread gauges**A.2.1 Gauges for internal screw threads****A.2.1.1 GO screw plug gauge**

This gauge checks that the virtual effective diameter and the major diameter of the product thread are not smaller than the minimum limits specified. It does not check the minimum minor diameter of the product thread since, for practical reasons, the root of the plug gauge has to be cleared.

The minor diameter is examined separately by means of a GO plain plug gauge made to the minimum minor diameter of the internal thread. It has to be possible to screw the GO screw plug gauge by hand, without using excessive force, into the complete length of the product thread. This gauge does not take account of any eccentricity between the crest and flank diameters of the internal product thread which might affect assembly. Any such eccentricity can be identified using a GO screw plug gauge provided with a pilot GO plain plug, the diameter of which is made to the minimum minor diameter of the internal thread. This ensures that:

- the effective diameter of the external thread does not exceed the maximum size specified for it; and
- the external thread will assemble with an internal thread having a minimum minor diameter.

Such a gauge does not ensure that the major diameter of the external thread is not too large since, for practical reasons, the root of the ring gauge has to be cleared.

The major diameter is examined separately by means of a GO plain calliper gauge made to the maximum major diameter of the external thread (see **A.2.2.3**). Here again any eccentricity between the crest and flank diameters of the thread will not be detected by the GO gauge. The amount of any eccentricity present is most readily determined by means of optical projection.

Since its purpose is to ensure, as far as possible, assembly of mating threads, a GO screw gauge should be perfect form and equal to the maximum metal size of the products being inspected.

NOTE When, for reasons of economy, standard gauge blanks are used in the manufacture of the gauge, the length of the gauge might be less than the length of engagement of the product threads. Suitable precautions have therefore to be taken when using the gauge.

A.2.1.2 NOT GO screw plug gauge

This gauge checks that the maximum effective diameter of the product thread is not too large. Ideally it should not be possible for the gauge to enter the product thread but, as internal threads are often slightly bell-mouthed, it is permissible to allow entry provided that, on withdrawal, disengagement takes place within two full turns of thread. If the product has a length of thread of three turns or less, the gauge should not screw completely through the product thread. The gauge should be applied by hand without using excessive force.

A.2.1.3 GO and NOT GO plain plug gauges

These gauges check that the minor diameter of the product thread is between its specified limits. The GO plain plug gauge should assemble completely with the product thread. The NOT GO plain plug gauge may enter the product thread by not more than a distance of two full turns of the thread. If the product has a length of thread of three turns or less, the NOT GO gauge should not pass completely through the product thread.

A.2.2 Gauges for external screw threads

A.2.2.1 Solid or adjustable GO screw ring gauge

This gauge checks that the virtual effective diameter of the product thread is not too large. The major and minor diameters of the product thread are not checked by this gauge. It should be possible to screw the gauge by hand, without using excessive force, over the complete length of the product thread.

A.2.2.2 Solid or adjustable NOT GO screw ring gauge

This gauge checks that the effective diameter of the product thread is not too small. Ideally it should not be possible for the product thread to enter the gauge but, as external threads are often slightly tapered at the leading end, it is permissible to allow entry provided that, on withdrawal, disengagement takes place within two full turns of thread. If the product has a length of thread of three turns or less the gauge should not screw completely on to the product thread. The gauge should be applied by hand without using excessive force.

A.2.2.3 Adjustable GO screw calliper gauge

This gauge is intended to check that the virtual effective diameter of the product thread is not too large. The major and minor diameters of the product thread are not checked by this gauge. The gauge is generally applied to the product thread under its own weight or in accordance with a fixed working load at three positions at least evenly spaced around the circumference of the thread. The gauge should pass completely over the product thread at any of the positions at which it is applied.

A.2.2.4 Adjustable NOT GO screw calliper gauge

This gauge checks that the effective diameter of the product thread is not too small. It is generally applied to the product thread under its own weight or under a fixed working load at three positions evenly spaced around the circumference of the thread. The gauge should not pass over the product thread except possibly for the first two turns of thread.

A.2.2.5 GO and NOT GO plain ring or calliper gauges

These gauges check that the major diameter of the product thread is between the specified limits. The gauges are applied to the product thread under the same conditions as the corresponding screw gauges.

A.2.2.6 Setting plugs (double length) for adjustable GO and NOT GO screw ring gauges

These setting plugs are used to set adjustable screw ring gauges to the specified effective diameters. Each setting plug has a length of thread approximately equal to twice the length of the screw ring gauge to be controlled. The effective diameter of the setting plug is constant throughout, but half the length of the setting plug has a full form thread and the remaining half has a truncated form of thread. The screw ring gauge is adjusted to be a snug fit on the full form portion of the setting plug. The setting plug is then unscrewed by hand, without using excessive force, through the screw ring gauge until the truncated portion of the setting plug completely engages the screw ring gauge. In the latter condition there should be no perceptible shake or play between the setting plug and the screw ring gauge: shake or play is an indication of an unacceptable error of thread form of the adjustable screw ring gauge.

A.2.2.7 Setting plugs (single length) for adjustable GO and NOT GO screw calliper gauges

These setting plugs are used to set the adjustable screw calliper gauges, and are approximately equal in length to the gauges. The setting plugs for the GO and NOT GO screw calliper gauges have full form threads. A calliper gauge is adjusted so that it just passes over the appropriate setting plug under its own weight or under a fixed working load.

For any given product size, setting plugs for calliper gauges are made slightly smaller in effective diameter than the corresponding setting plugs for adjustable ring gauges. This difference in size permits the results obtained by a calliper gauge to be compared with those obtained with an adjustable ring gauge.

Single-length setting plugs provide little help in detecting any error in thread form caused by wear of the calliper gauge anvils, so it is necessary to examine periodically for such error by other means.

A.2.2.8 Screw check plugs for new solid GO and NOT GO screw ring gauges

These screw check plugs are used to check that the effective diameters of screw ring gauges are within the specified limits. It should be possible to screw the GO check plug by hand completely through the appropriate screw ring gauge. The NOT GO check plug, when screwed by hand without excessive force, may be allowed to enter both ends of the screw ring gauge provided that, on withdrawal, disengagement takes place within one full turn of thread.

When setting a new calliper gauge with the setting plugs discussed in **A.2.2.7**, an additional check should be made with the NOT GO check plug for the corresponding new screw ring gauge. The latter check may also be applied to a used calliper gauge to ensure that the thread form is not worn. The wear check plug for the screw ring gauge should not be used as a wear check plug for the calliper gauge.

A.2.2.9 Plain check plugs for new solid GO and NOT GO screw ring gauges

These check plugs are used to verify that the minor diameter of a screw ring gauge is between the specified limits. A GO check plug should assemble completely with the screw ring gauge. A NOT GO check plug may enter both ends of the screw ring gauge by not more than a distance of one turn.

A.2.2.10 NOT GO screw wear check plugs for used solid GO and NOT GO screw ring gauges

These wear check plug gauges are used to check that the appropriate solid screw ring gauges have not worn beyond the specified limits of wear.

A wear check plug gauge, when screwed by hand without excessive force, may be allowed to enter both ends of the screw ring gauge provided that, on withdrawal, disengagement takes place within one full turn of thread.

A.2.3 Check gauges

GO and NOT GO screw check gauges verify that new solid type ring gauges are within limits. They correspond to the GO and NOT GO screw plug gauges used for testing the product but are made to much finer tolerances. They serve as an alternative to direct measurement in the testing of ring gauges above, say, $\frac{1}{4}$ inch in diameter. Check gauges are indispensable for sizes smaller than $\frac{1}{4}$ inch in diameter, which is about the limit of size for direct measurement.

NOT GO effective diameter checks also ensure that solid GO ring gauges are not allowed to remain in service after they have worn by a specific amount.

A.2.4 Use of screw gauges

It is not necessary for all the different types of screw gauges described in **A.2.1** and **A.2.2** to be used for checking external threads on products, but it is essential for one of the types of GO screw gauges and one of the types of NOT GO screw gauges to be used.

A solid or adjustable GO screw ring gauge should always be used for gauging the maximum effective diameter of an external thread but, to save time in checking, a GO screw calliper gauge may be employed. Gauging with a GO screw calliper gauge should be supplemented by random sampling with a GO screw ring gauge to give greater assurance that parts outside the limits are not accepted. In cases of dispute, gauging with a GO screw ring gauge is decisive.

A GO screw calliper gauge should *not* be used if the manufacturing process is likely to introduce errors in the product thread which this gauge is not certain to detect, e.g. lobing, local pitch errors in milled threads and burrs at the start of the thread. Further, a GO screw calliper gauge is not suitable for checking non-rigid, e.g. thin-walled, parts which would deform when the gauge is applied; in such cases a GO screw ring gauge should be used.

For large screw threads (over about 100 mm diameter) the size to which the GO screw calliper gauge is set may be reduced to compensate for the effect of form errors that could occur in these threads; this reduces the possibility of accepting screw threads that are outside the specified limits.

A NOT GO screw calliper gauge should be used to check the minimum effective diameter of an external thread. The solid or adjustable NOT GO screw ring gauge should only be used to check non-rigid product threads, e.g. those on thin-walled parts which would deform if a NOT GO screw calliper were applied.

A.2.5 Advantages and disadvantages of solid screw ring gauges, adjustable screw ring gauges and calliper gauges

A.2.5.1 GO gauges

The solid GO screw ring gauge provides the most reliable practical means of proving that the form of a product thread falls wholly within the maximum metal limits.

One of its disadvantages is its short life due to wear. Another is that its effective diameter has either to be checked for size by direct measurement or by check plug gauges. Sizes below $\frac{1}{4}$ inch in diameter are outside the range of solid GO screw ring gauges and have to be tested by check gauges. Further, if a gauge is on its lower limit of size, it might reject satisfactory work which is on the high limit of size.

Theoretically, the adjustable GO screw ring gauge is as reliable as the solid GO screw ring gauge in checking the complete surface of the external thread. The gauge is set to size by means of a threaded setting plug. The effective diameter tolerance zone for this plug is placed just inside the product tolerance zone (see Figure 1), the aim being to set the effective diameter of the ring gauge on the high limit for the external thread. According to the extent to which angle and pitch errors on plug and ring match or oppose each other, the effective diameter of the ring gauge is set either slightly above or slightly below the high limit for the external thread. Thus, when gauging external threads bordering on the high limit, the adjustable ring gauge can only function at a somewhat lower level of certainty than the solid type.

The main advantage of the adjustable gauge is that it can be reset to size after it has worn. Although the process of adjustment changes the shape of the gauge such that it no longer makes contact all round the circumference of the setting plug or screw under test, the shape can be restored by grinding or lapping or both. Notes on the setting of adjustable screw ring gauges are given in Annex E.

The adjustable calliper gauge, like the adjustable ring gauge, has the advantage that it can be set and reset to size by means of a setting plug. It does not, however, envelope the external thread and so, unless applied at a number of positions round the external thread, it might accept an oval thread which is partly oversize. Further, whether the gauge is of the fixed anvil type or the floating roller type, it cannot take account either of lobbing error or drunkenness of helix in the external thread. The fixed anvil type does not necessarily take account of drunkenness of helix: for the larger sizes, lateral "give" in the frame can allow the anvils to accommodate themselves to the screw in the pitchwise direction. Some types of calliper gauges can also give different results according to the force of application of the external thread to the anvils or to the method of presentation of the thread to the anvils. See also **A.2.2.6** and **A.2.2.7**.

Although the calliper gauge is less certain than the ring gauge, either solid or adjustable, of achieving the primary purpose of a GO screw gauge, practical experience has shown that, with care, it can be used satisfactorily as a maximum metal gauge.

A.2.5.2 NOT GO gauges

Of the various types of NOT GO effective diameter screw gauges for external threads, the calliper gauge is the more efficient since its performance is not affected by the existence of a thick or damaged thread at the point of the screw under test. Such a defect can completely prevent the ring gauge from detecting a thread which is, in the main, undersize. The calliper also detects an oval screw which is partly undersize and an undersize lobed screw, both of which would be undetected by the ring gauge.

In the case of threads on thin tubing it might be desirable to use a NOT GO ring gauge in preference to a calliper.

A.2.6 Tolerance zones

The product should accept, or be accepted by, a GO gauge over the whole length of engagement. To avoid acceptance of a workpiece whose size is outside the limits specified on the drawing, the tolerance zones for GO gauges are placed *inside* the product limits (see Figure 1).

Since the tolerance zones for the NOT GO gauges are placed just *outside* the product tolerance zones (see Figure 1) the NOT GO screw plug gauge should, ideally, not enter the workpiece, nor should the NOT GO screw ring gauge be entered by the external thread.

Since internal work is nearly always slightly bell-mouthed, and external work often slightly tapered at the point, the inspector may allow entry in both cases, provided that, on withdrawal, disengagement takes place within two full turns of thread.

NOTE The tolerance zones for NOT GO (HI plug and LO ring) gauges, normally used in the USA for product acceptance, are placed inside the product limits. In American practice threads are acceptable as being within the minimum metal limits if, when using plug and ring threaded gauges, the HI gauge does not enter or the LO gauge is not entered. Threads are also acceptable if all complete threads can enter in the LO gauge or be entered by the HI gauge, provided that a definite drag fit results from metal to metal contact on or before the third turn of entry.

The length of thread on NOT GO effective diameter calliper gauges should not exceed three pitches for satisfactory functioning. The length of thread on other types of NOT GO gauges need not be so restricted.

A.2.7 Gauge wear

All solid screw ring gauges should be inspected periodically for wear by means of the appropriate NOT GO wear check plugs. GO and NOT GO screw plug gauges should similarly be regularly checked by measurement. The thread profiles of all screw gauges should be inspected regularly for wear.

GO gauges should not be permitted to wear beyond the maximum metal limit of the product thread. If, for reasons of economy, gauges are permitted to wear beyond the maximum metal limit when used for final inspection of Class 1 and 2 threads, the amount of this wear should not be permitted to exceed the tolerance on the gauge.

Resetting adjustable ring and calliper gauges by means of setting plugs ensures that such gauges are not allowed to become seriously oversize. In addition, provision is made for NOT GO effective diameter checks for checking the wear of solid GO ring gauges.

The wear of NOT GO gauges does not present so serious a problem since assembly of product is not affected by this. Wear to a NOT GO gauge causes it to become gradually less accurate in the inspection of the product.

A.2.8 Limitations of thread gauging practice

Conventional limit gauging does not in itself ensure that product threads are completely satisfactory. For example, the form and finish of the roots of external threads are not controlled precisely by the gauges covered by this standard, yet they are features which can have a large effect upon the strength of the thread. Much depends upon the accuracy of the tools and the methods used in the production of the thread. The maintenance, by use of optical projection, of good profiles on the threading tools as a basis for obtaining good profiles on the product threads, is of particular importance if conventional gauging is to be effective in inspecting screw threads.

A.3 Inspection of product threads by direct measurement

Measurement of the crest diameter of either an external or internal thread is straightforward, but measurement of the more important effective diameter is less so. Thread measuring wires are normally used to measure this element on external threads but, as they make point contacts with the flanks, they can either ride on the top of a high spot or settle in a cavity if the flanks are at all irregular. The flanks should therefore be inspected on an optical projector before deciding whether the localized measurement is a fair indication of the actual size of the screw. Supplementary measurements with wires of slightly different diameter may be made. Care is similarly necessary in interpreting the measurement of the effective diameter of an internal thread if made on an internal comparator with ball-points.

After the size of the effective diameter has been established, the virtual effective diameter from the flank angle errors and the pitch errors¹⁾ is calculated. This calculated diameter, together with the measured effective diameter, is compared with the effective diameter limits specified. The estimated accuracy of the measurements should be taken into account when deciding whether the thread is within the specified limits. The calculation of the virtual effective diameter is straightforward when the flanks of the thread are straight. If they are curved, the virtual effective diameter has to be carefully computed from the pitch error and a study of the thread form viewed on the optical projector. Care is necessary in making correct pitch measurements on a screw with irregular flanks.

Direct measurement of the effective diameter of an internal thread of satisfactory form can generally be avoided by fitting it, during manufacture, to a mating external component of known size and of satisfactory form. In cases where interchangeability of components is essential, it is necessary to select an external component which was on the maximum metal limit of size.

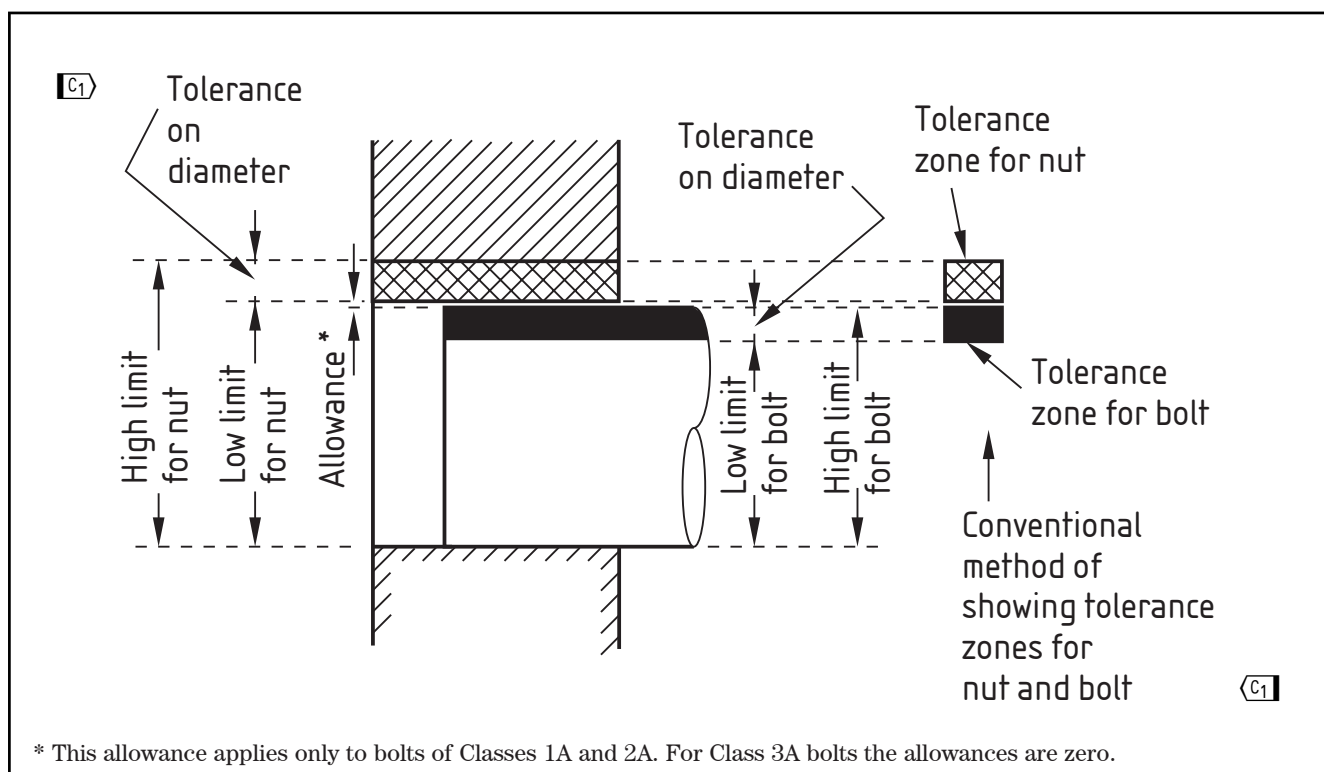
NOTE Thread micrometers and thread measuring parallels are also used to measure the effective diameter of external threads. These give a measure of the effective diameter plus the virtual increase due to any angle error present.

¹⁾ For effective diameter equivalent of the flank angles and pitch errors, see Annex C.

Annex B (informative) Conventional illustration of tolerance zones

The left-hand portion of Figure B.1 illustrates the limits and tolerances for the effective diameter of internal and external threads. For convenience, the pitch cylinders of nut and bolt are shown in contact at the bottom so that the whole of the tolerance on each mating part is shown at the top. The tolerance zone for the effective diameter of the nut is shown by the cross-hatched area and that for the effective diameter of the bolt by the black area.

Figure B.1 Limits and tolerances for the effective diameters of internal and external threads



Annex C (informative) Effective diameter equivalent of pitch and angle errors

The effective diameter of a screw plug gauge is determined by thread-measuring cylinders, the diameters of which are so chosen as to make contact at or very close to the pitch line of the gauge. Similarly, the effective diameter of a screw ring gauge is measured with the aid of ball-ended feeler points which make contact at or very close to the pitch line of the gauge.

The measurement of the effective diameter of a screw plug or screw ring gauge takes no account of any errors present in the pitch or flank angles of the gauge. These errors make a plug behave as if its effective diameter is larger than the measured diameter and make a ring behave as if its effective diameter is smaller than the measured diameter, by an amount depending upon the magnitude of the errors. This effectively larger size in the case of a plug or effectively smaller size in the case of a ring is the virtual effective diameter ("effective size" in the USA).

The effective diameter equivalent of errors in pitch and angle for unified threads, is calculated thus:

$$\delta E = (1.732 \times \delta p) + [0.000\ 182 \times p (\delta \theta_1 + \delta \theta_2)] \text{ approx.}$$

where:

δp is the maximum error in the relative displacement of any two threads along the gauge,

$\delta \theta_1$ and $\delta \theta_2$ are the errors in the slopes of the opposite flanks of the thread in minutes, regardless of sign,

δE is the effective diameter equivalent of the above errors in the pitch and flank angles of the gauge.

Table C.1 and Table C.2 give the calculated effective diameter equivalents of various pitch and angle errors. When the errors in pitch and flank angles of a gauge have been measured, the combined effective diameter equivalent is obtained by adding together the equivalent values in Table C.1 and Table C.2.

The virtual effective diameter of a plug gauge is obtained by adding the combined effective diameter equivalent to the effective diameter of the gauge, and that of a ring gauge by subtracting the combined effective diameter equivalent from the effective diameter of the gauge.

Solid screw ring gauges may be tested with check gauges, which automatically take account of pitch and angle errors, or by direct measurement. If they are tested by direct measurement it is necessary to verify that the virtual as well as the measured effective diameter is within the limits specified for the effective diameter.

The maximum permissible effective diameter equivalent of pitch and angle errors is obtained by subtracting from the effective diameter tolerance given in the tolerance table (ignore sign) the amount by which the measured effective diameter is below its upper limit.

Example: Referring to Table 4, if a 1 in \times 12 t.p.i. GO screw ring gauge measures 0.000 3 in below its upper limit of effective diameter, the maximum effective diameter equivalent of pitch and angle errors permissible is 0.000 8 in $-$ 0.000 3 in = 0.000 5 in.

For further information on the effective diameter equivalent of pitch and angle error, see the NPL booklet, "Notes on Applied Science No. 1 – Gauging and measuring screw threads" [1].

Table C.1 **Effective diameter equivalents of errors in pitch**

Error in pitch of gauged δp	Effective diameter equivalent, $1.732 \times \delta p$
in	in \times 0.000 1
0.000 05	0.9
0.000 1	1.7
0.000 15	2.6
0.000 2	3.5
0.000 25	4.3
0.000 3	5.2
0.000 35	6.1
0.000 4	6.9
0.000 45	7.8

Annex D (informative) **A system of gauging for screw threads before and after coating**

D.1 General

Table D.1 to Table D.6 recommend a system of gauging for controlling the sizes of screw threads coated in accordance with BS 3382, which specifies the thickness of coating in the form of limits for the maximum and minimum average thicknesses in a batch of screw threads and gives methods for determining the average thickness of coating.

By existing commercial methods it is only possible to check the *average* thickness of the coating on a screw thread. In practice the thicknesses of coating on the threads in a batch are variable and, in addition, the coating tends to build up towards the crest of any thread and towards the leading end of any long screw. It is possible, though unlikely, that a screw thread made to the tolerances for uncoated threads given in this annex and subsequently coated in accordance with the batch average thicknesses specified in BS 3382 might not be accepted by the GO gauges recommended for use after coating. This would only occur if the size of an uncoated thread approached its specified maximum metal size and the thickness of coating was near the maximum specified value.

If coated screw threads are rejected by a GO gauge then:

- firstly, the coating should be stripped from the thread by a recommended chemical process and its average thickness determined by a weighing operation; and
- secondly, the screw thread from which the coating has been removed should be gauged to determine whether it conformed to the appropriate limits of size in its pre-coated condition.

D.2 External screw threads

Table D.1 **External threads with specified allowances which have to be maintained after coating – Unified threads, Class 1A**

Gauges for use before coating	Gauges for use after coating
GO thread gauge to check that the maximum metal limit does not exceed the Class 1A maximum metal limit specified in BS 1580, reduced by 0.001 5 in.	GO thread gauge to check that the Class 1A maximum metal limits, as specified in BS 1580, has not been exceeded.
NOT GO effective diameter gauge to check that the effective diameter is not less than the minimum specified for the Class 1A thread.	NOT GO gauging of the minimum effective diameter after coating is not recommended. The minimum metal limit has to be controlled before coating, but where this is impossible a purchaser may adopt either of the following methods: i) the coating may be removed from a sample (or samples) and the threads checked with a NOT GO effective diameter gauge made to the minimum effective diameter specified for the Class 1A thread, or ii) an approximate check may be made, without removal of the coating, by using the same gauge.
GO plain calliper gauge to check that the major diameter does not exceed the specified Class 1A maximum limit reduced by 0.001 5 in.	GO plain calliper gauge to check that the major diameter does not exceed the specified Class 1A maximum limit.
NOT GO plain calliper gauge to check that the major diameter is not less than the minimum specified for the Class 1A thread.	
<p><i>NOTE For certain cases involving the use of Class 2A threads it may be necessary to maintain the allowance after coating. To meet this special requirement the above recommendations should be followed, replacing where appropriate "Class 1A" by "Class 2A" and $\langle C_1 \rangle$ "0.001 5 in" by "0.001 0 in" $\langle C_1 \rangle$.</i></p>	

Table D.2 **External screw threads with specified allowances (in the uncoated condition) which can be absorbed by the coating – Unified threads, Class 2A**

Gauges for use before coating	Gauges for use after coating
GO thread gauge to check that the Class 2A maximum metal limit before coating, as specified in BS 1580, has not been exceeded.	GO thread gauge to check that the maximum metal limit after coating (basic size), as specified in BS 1580, has not been exceeded. The GO gauge for Class 3A threads is suitable for this purpose.
NOT GO effective diameter gauge to check that the effective diameter is not less than the minimum specified for the Class 2A thread.	NOT GO gauging of the minimum effective diameter after coating is not recommended. The minimum metal limit has to be controlled before coating but where arrangement for this is impossible a purchaser may adopt either of the following methods: i) the coating may be removed from a sample (or samples) and the threads checked with a "before coating" effective diameter NOT GO gauge, or ii) an approximate check may be made, without removal of the coating, by using the same gauge.
GO plain calliper gauge to check that the major diameter does not exceed the specified Class 2A maximum limit before coating.	GO plain calliper gauge to check that the major diameter does not exceed the Class 2A maximum limit specified after coating (basic size).
NOT GO plain calliper gauge to check that the major diameter is not less than the minimum specified for the Class 2A thread.	

Table D.3 External screw threads with no specified allowance – Unified threads, Class 3A

Gauges for use before coating	Gauges for use after coating
GO thread gauge to check that the maximum metal limit does not exceed the maximum specified in BS 1580, reduced by 0.001 in.	GO thread gauge to check that the maximum metal limit does not exceed the maximum specified in BS 1580.
NOT GO effective diameter gauge to check that the effective diameter is not less than the minimum Class 3A limit specified in BS 1580, by more than 0.001 in.	NOT GO gauging of the minimum effective diameter after coating is not recommended. The minimum metal limit has to be controlled before coating (see Table D.2).
GO plain calliper gauge to check that the major diameter is not greater than the maximum specified in BS 1580, reduced by 0.001 in.	GO plain calliper gauge to check that the major diameter is not greater than the maximum specified in BS 1580.
NOT GO plain calliper gauge to check that the major diameter is not less than the minimum Class 3A limit specified in BS 1580 by more than 0.001 in.	

D.3 Internal screw threads

Table D.4 Unified threads, Classes 1B and 2B

Gauges for use before coating	Gauges for use after coating
GO thread gauge to check that the effective and major diameters are greater than the minimum values specified in BS 1580 by an amount sufficient to allow coating of threads. An amount of 0.001 in on diameter is recommended for nuts of nominal diameter No.10 or greater. For nuts in the other American numbered sizes the following values are recommended: No.8: 0.000 8 in; No.6: 0.000 7 in; No.5: 0.000 6 in; No.4: 0.000 5 in; No.3: 0.000 4 in; No.2: 0.000 3 in. No amount is recommended for nuts of nominal diameters smaller than No. 2.	GO thread gauge to check that the effective and major diameters are not less than the minimum values specified in BS 1580.
NOT GO effective diameter gauge to check that the effective diameter does not exceed the maximum limit specified in BS 1580 for the particular class of thread. <i>NOTE For the numbered sizes the recommended coating margins are not considered to be practicable unless American type high addendum NOT GO effective diameter (HI) plug gauges are used.</i>	
GO plain plug gauge to check that the minor diameter is greater than the minimum specified in BS 1580 by an amount equal to that given above for the thread in question.	GO plain plug gauge to check that the minor diameter is not less than the minimum specified in BS 1580.
NOT GO plain plug gauge to check that the maximum minor diameter specified in BS 1580 is not exceeded.	

Table D.5 Unified threads, Class 3B

BS 1580 strongly recommends that Class 2B coated nuts are used in place of Class 3B coated nuts.

D.4 D.4 Summary of gauges for checking Unified threads

Table D.6 summarizes the various GO and NOT GO gauges (screw gauges, and plain gauges for crests of threads) required for checking product threads which are not coated in the finished state, or if coated, in the two stages before and after coating. The table shows that some of the gauges can serve more than one purpose.

Table D.6 **Summary of GO and NOT GO screw gauges and plain gauges for checking unified threads**

Class of thread and limit to be gauged	Designation and type of gauge required		
	Uncoated	Before coating	After coating
1A max. limit	2A GO	2A GO – 0.001 5 in	2A GO
2A max. limit	2A GO	2A GO	Basic
3A max. limit	Basic	Basic – 0.001 in	Basic
1A min. limit	1A NOT GO	1A NOT GO	None recommended
2A min. limit	2A NOT GO	2A NOT GO	None recommended
3A min. limit	3A NOT GO	3A NOT GO – 0.001 in	None recommended
1B min. limit	Basic	Basic + 0.001 in	Basic
2B min. limit	Basic	Basic + 0.001 in	Basic
3B min. limit	Basic	Basic + 0.001 in ^{A)}	None recommended
1B max. limit	1B NOT GO	1B NOT GO	None recommended
2B max. limit	2B NOT GO	2B NOT GO	None recommended
3B max. limit	3B NOT GO	3B NOT GO ^{A)}	None recommended

^{A)} Class 2B coated nuts should be used instead of Class 3B coated nuts.

Annex E (informative) Setting to size of adjustable screw ring gauges

An adjustable ring gauge should be ground or lapped to a size (effective diameter) slightly larger than that of the setting plug by which it will subsequently be set to size. Otherwise, if, in setting the gauge, it has to be opened out to admit its setting plug, the tendency is to turn the gauge into a “shaving tool” necessitating frequent resetting due to local wear of the threads. This shaving condition is easily recognized in a gauge with two adjusting slots by the harshness of the motion when the setting plug is rotated in the ring. In a gauge with a single adjusting slot, the setting plug will shake at right angles to the slot although it is a tight fit in line with the slot.

When a ring with either one or two adjusting slots is *closed in* to fit a setting plug, satisfactory contact is obtained over two or three sectors respectively. Grinding the setting plug and the lap for a ring gauge wherever possible on the same machine ensures that any residual errors in their flank angles and their pitches (within the specified tolerances) match each other closely particularly in the sign of the errors.

In setting an adjustable thread ring gauge the sealing compound should be removed and the locking screw loosened. Turning the adjusting screw to the right enlarges the ring so that it turns freely on the setting plug. Alternately turning the adjusting screw and tightening the locking screw, should result in a firm fit on the smallest portion of the thread in the ring. While making the adjustment the knurled outside diameter and both sides of the ring should be lightly tapped with a soft-tip or plastic hammer to permit the threads of the ring to wrap themselves around the thread of the setting plug. After satisfactory adjustment, the ring is removed from the plug and the same procedure of tapping repeated with slightly greater emphasis to the sides. If the thread ring gauge possesses proper rigidity, the same feel should still be there when the setting gauge is again turned into the ring. A tighter fit or inability to re-enter the setting gauge denotes a fault of the locking device, which should then be taken apart and checked for dimensional conformity to ASME B47.1. It is often advisable to do this before even attempting to adjust the thread ring gauge. When proper adjustment has been obtained the gauge should be sealed.

In setting to size a truncated setting plug the ring gauge may be set to either the full or the truncated portion. It is common practice to set slightly freer than a snug fit to the truncated portion and then to check the root clearance and wear of flank angle by screwing the ring on to the full portion. Extreme caution is required when this practice is followed to prevent damage to the thread crest of the setting plug. The opposite practice is to adjust and set the ring to the full portion and then determine the fit of the gauge on the truncated portion. If the thread form of the ring gauge is satisfactory there will be slight or no change of fit. In the case of a worn thread ring gauge, the presence of shake or play when on the truncated portion indicates that the sides of the thread are no longer straight near the root and the gauge should be relapped or discarded.

To ensure maximum wear life, a setting plug should be threaded into a ring as few times as possible. This reduces uneven wear and prevents a taper on the truncated end of the plug. However, when setting plugs are applied repeatedly to check thread ring gauges, the criteria for acceptability vary with the types and applications of the rings. A NOT GO ring, for example, should be a snug fit at full engagement and provide some resistance to turning at one or two turns engagement. GO thread ring gauges should also be a snug fit at full engagement. When the length of the product thread permits engagement with the full length of the GO ring, a slightly freer fit may be permitted. However, there should be no relaxation in the recommendation when short product threads that only partly engage the GO ring are being fitted.

If a basic-crest setting plug is used to set a thread ring gauge, root clearance of the thread in the ring should be determined by optical projection of a cast of the thread.

The ring gauge should be inspected further to determine whether or not the minor diameter is within the specified limits. The minor diameter may be inspected by means of GO and NOT GO plain cylindrical plug acceptance check gauges or by direct measurement.

Annex F (informative)

Comparison between the designations of British and American gauges

The first column lists the nomenclature of British gauges referred to in this standard. The second column lists the designations of American gauges referred to ASME/ANSI B1.2-1983 and H28 (1957) [2]. Equivalent gauges are shown opposite each other in the columns.

Gauges to BS 919

1. GO screw plug gauge.
2. NOT GO screw plug gauge – low addendum.
3. NOT GO screw plug gauge – high addendum.
4. GO plain plug gauge for minor diameter.
5. NOT GO plain plug gauge for minor diameter.
6. GO screw ring gauge – solid type – and associated check plugs.
7. NOT GO effective diameter ring gauge – solid type – and associated check plugs.
8. Adjustable GO screw ring gauge.
9. Adjustable GO screw calliper gauge.
10. Adjustable NOT GO screw ring gauge.
11. Adjustable NOT GO screw calliper gauge.
12. Double length setting plug for adjustable GO screw ring gauge.
13. Double length setting plug for adjustable NOT GO screw ring gauge.
14. —
15. —
16. Single length setting plug $\boxed{G_1}$ for $\boxed{G_1}$ adjustable GO screw calliper gauge.
17. Single length setting plug for adjustable NOT GO screw calliper gauge.
18. GO plain calliper (gap) gauge for major diameter.
19. NOT GO plain calliper (gap) gauge for major diameter.

Gauges in ASME/ANSI B1.2 and H28 (1957)

- GO thread plug gage.
- HI thread plug gage (plus tol.) – ASME/ANSI B1.2. Thread plug gage (plus tol.) H28.
- GO plain plug gage for minor diameter.
- HI plain plug gage for minor diameter – ASME/ANSI B1.2.
NOT GO plain gage for minor diameter – H28.
-
-
- GO thread ring gage.
-
- LO thread ring gage (minus tol. gage) – ASME/ANSI B1.2.
 $\boxed{G_1}$ NOT GO thread ring gage (minus tol. gage) – H28. $\boxed{G_1}$
-
- Truncated setting plug for GO thread ring gage.
- Truncated setting plug for LO thread ring gage (minus tol. gage) – ASME/ASA B1.2. Truncated setting plug for NOT GO thread ring gage (minus tol. gage) – H28.
- Setting plug for GO thread ring gage (alternate) – ASME/ANSI B1.2.
- Basic crest setting plug for GO thread ring gage – H28.
- Setting plug for LO thread ring gage (alternate) – ASME/ANSI B1.2
- Basic crest setting plug for NOT GO thread ring gage – H28.
- Setting plug for LO thread ring gage (alternate) – ASME/ANSI B1.2.
- Basic crest setting plug for NOT GO thread ring gage – H28.
-
-
- GO plain ring or snap gage for major diameter.
- LO plain ring or snap gage for major diameter – ASME/ANSI B1.2.
- NOT GO plain gage for major diameter – H28.

Annex G (informative)

Tolerances for major, effective and minor diameters and flank angle and pitch

G.1 Permissible deviations in diameter

BS 1580 specifies maximum and minimum limits for the major, effective and minor diameters of three classes of unified threads, with the exception of the major diameter of internal threads for which only the minimum limit is stated.

The permissible size variations *may* exist not only between separate screw threads of a given class, but also in any individual screw thread; for example, the diameters of a $\frac{1}{2}$ -20 UNP *bolt* to Class 2A are permitted to vary in size as follows:

	Maximum size (uncoated)	Minimum size (uncoated)	Tolerance
	in	in	in
Major diameter	0.498 7	0.490 6	0.008 1
Effective diameter	0.466 2	0.461 9	0.004 3
Minor diameter	0.437 4	0.429 5	0.007 9

G.2 Permissible deviations in flank angle and pitch

BS 1580 specifies no tolerances for deviations in the pitch or the flank angles for the $\boxed{C_1}$ external $\langle C_1 \rangle$ thread, but it does specify that, while the actual effective diameter of the thread shall be not less than the minimum size specified for that element (i.e. 0.461 9 in), the sum of the effective diameter and the effective diameter equivalent of the errors present in the pitch and flank angles shall be not greater than the maximum size specified (i.e. 0.466 2 in). That is, the minimum limit for the effective diameter of the $\boxed{C_1}$ external thread $\langle C_1 \rangle$ relates to its effective diameter, whilst the maximum limit refers to its virtual effective diameter.²⁾

$\boxed{C_1}$ An external thread $\langle C_1 \rangle$ with effective diameter on *maximum* size or $\boxed{C_1}$ an internal thread $\langle C_1 \rangle$ with effective diameter on *minimum* size could be permitted no deviations at all in flank angles or pitch.

$\boxed{C_1}$ An external or internal thread $\langle C_1 \rangle$ with effective diameter lying somewhere between the permissible limits of size might have limited deviations in angle and pitch, the amounts depending upon the difference between the actual effective diameter and the maximum limit of size in the case of $\boxed{C_1}$ an external thread $\langle C_1 \rangle$, and the minimum tolerance in the case of $\boxed{C_1}$ an internal thread $\langle C_1 \rangle$.

While BS 1580 gives no specific tolerances for deviations of flank angles and pitch of a product thread, the permissible deviations of these elements are intended to be controlled by the tolerance quotes for the effective diameter.

²⁾ Further information is given in the NPL booklet "Notes on Applied Science No. 1 – Gauging and measuring screw threads" [1].

Annex H (informative) Hardness

A steel gauge should be hardened to the value most appropriate to its type, size and pitch and to the steel from which it is made.

Experience has shown that if the hardness of steel gauges is kept within the range 650 HV to 800 HV (57 HRC to 62 HRC) the threads do not easily burr nor are they brittle.

Experience has also shown that the gauging surfaces of plain plug and calliper gauges should be hardened within the range 750 HV to 850 HV (61 HRC to 63 HRC).

Bibliography

Standards publications

BS 1580-1, *Unified screw threads – Part 1: Screw threads with diameters $\frac{1}{4}$ in and larger – Requirements*

BS 1580-3, *Unified screw threads – Part 3: Screw threads with diameters below $\frac{1}{4}$ in – Requirements*

BS 3382 (all parts), *Specification for electroplated coatings on threaded components*

☐ Text deleted ☐

ASME/ANSI B1.2:1983, *Gages and Gaging For Unified Inch Screw Threads*

ASME B47.1:1988 (R2004), *Gage Blanks*

Other publications

[1] NATIONAL PHYSICAL LABORATORY, “*Notes on Applied Science No. 1 – Gauging and measuring screw threads*”, TSO. Available at http://www.npl.co.uk/length/screw_thread_booklet/screw_gauge_booklet.html

[2] *National Bureau of Standards Handbook H28* (1957)

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