

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This Part of BS 919 supersedes BS 919-1:1960, which is withdrawn.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

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

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:

- a) screw plug gauges and setting plugs in sizes below 0.150 in and/or with external cone centres; and
- b) 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 $\boxed{C_1}$ 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		
								Minutes + or –
80	+3		+2				1½	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
36 $\sqrt{C_1}$	+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 $\sqrt{C_1}$	2 $\sqrt{C_1}$	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 $\times 0.000\ 1$
	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 $\times 0.000\ 1$

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								Cleared as shown in Figure 2
	0.1	–5						–5	
0.1	0.5		–6	–6	–7			–6	
0.5	1.5		–7	–8	–8	–8		–7	
1.5	3.0		–8	–8	–9	–9	–10	–8	
3.0	5.0			–9	–10	–11	–12	–9	
5.0	8.0			–10	–11	–12	–12	–10	
8.0	12.0				–12	–12	–13	–12	

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								Cleared as shown in Figure 4c)
	0.1	–4						+5	
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 $\langle C_1 \rangle$ 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 $\times$ 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 $\times$ 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 +4	0 −3	
0.5	1.5	+3 +6	0 −4	
1.5	3.0	+4 +8	0 −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:

- a) maximum effective diameter of external thread $+3H/4$ + major diameter tolerance of check plug;
- b) minimum effective diameter of external thread $+3P/4$ + major diameter tolerance of check plug;
- c) 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).