British Standard

BRITISH STANDARD

BS 21:1985

Reprinted, incorporating Amendment No. 1

Specification for

Pipe threads for tubes and fittings where pressure-tight joints are made on the threads (metric dimensions)

621.643.414 – 762.4:621.882.082.22

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Piping Systems Standards Committee (PSE/-) to Technical Committee PSE/9, upon which the following bodies were represented:

Association of Hydraulic Equipment Manufacturers
British Compressed Air Society
British Gas Corporation
British Hydromechanics Research Association
British Internal Combustion Engine Manufacturers' Association
British Malleable Tube Fittings Association
British Steel Industry
British Valve Manufacturers' Association Ltd.
Department of Trade and Industry (National Engineering Laboratory)
Energy Industries Council
Engineering Equipment and Materials Users' Association
Gauge and Tool Makers' Association
Institution of Civil Engineers
Institution of Gas Engineers
Institution of Public Health Engineers
Institution of Water Engineers and Scientists
Water Authorities Association
Water Companies Association
Wrought Fitting Makers' Association

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Amendments issued since publication

Amd. No.	Date of issue	Comments
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Contents

Foreword

This revision of BS 21 has been prepared under the direction of the Piping Systems Standards Committee and supersedes BS 21:1973 which is withdrawn. The basic thread is that given in ISO 7/1-1982 published by the International Organization for Standardization (ISO) but this standard also includes requirements for longscrew threads and for thread forms, and recommended methods of gauging threads, given in the previous edition of BS 21.

The implementation of ISO 7/2-1982 has not been considered necessary as the dimensional and geometrical controls imposed by the ISO gauging system are available through the BS 21:1973 gauging system, which has been retained in this edition.

This edition of this standard relates to metric dimensions only.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 16, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This British Standard specifies requirements for the following pipe threads.

a) Jointing threads, which are pipe threads for joints made pressure-tight by the mating of the threads and are taper external, taper internal or parallel internal threads.

NOTE 1 Parallel external pipe threads are not suitable as jointing threads.

b) Longscrew threads, which are parallel pipe threads used for longscrews (connectors) specified in BS 1387 where a pressure-tight joint is achieved by the compression of a soft material on to the surface of the external thread by tightening a backnut against a socket.

Thread sizes from $^{1}/_{16}$ to 6 inclusive are covered by this standard and requirements for thread forms, dimensions and tolerances are given, together with the designation of each type of thread.

NOTE 2 Appendix B gives methods of verification of jointing thread dimensions and form using recommended gauging systems described in Appendix A.

NOTE 3 Reference should be made to BS 2779 for requirements for pipe threads where pressure-tight joints are not made on the threads.

NOTE 4 The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this British Standard the following definitions apply (see Figure 1).

2.1
gauge diameter

the basic major diameter of the thread, whether external or internal, at the gauge plane

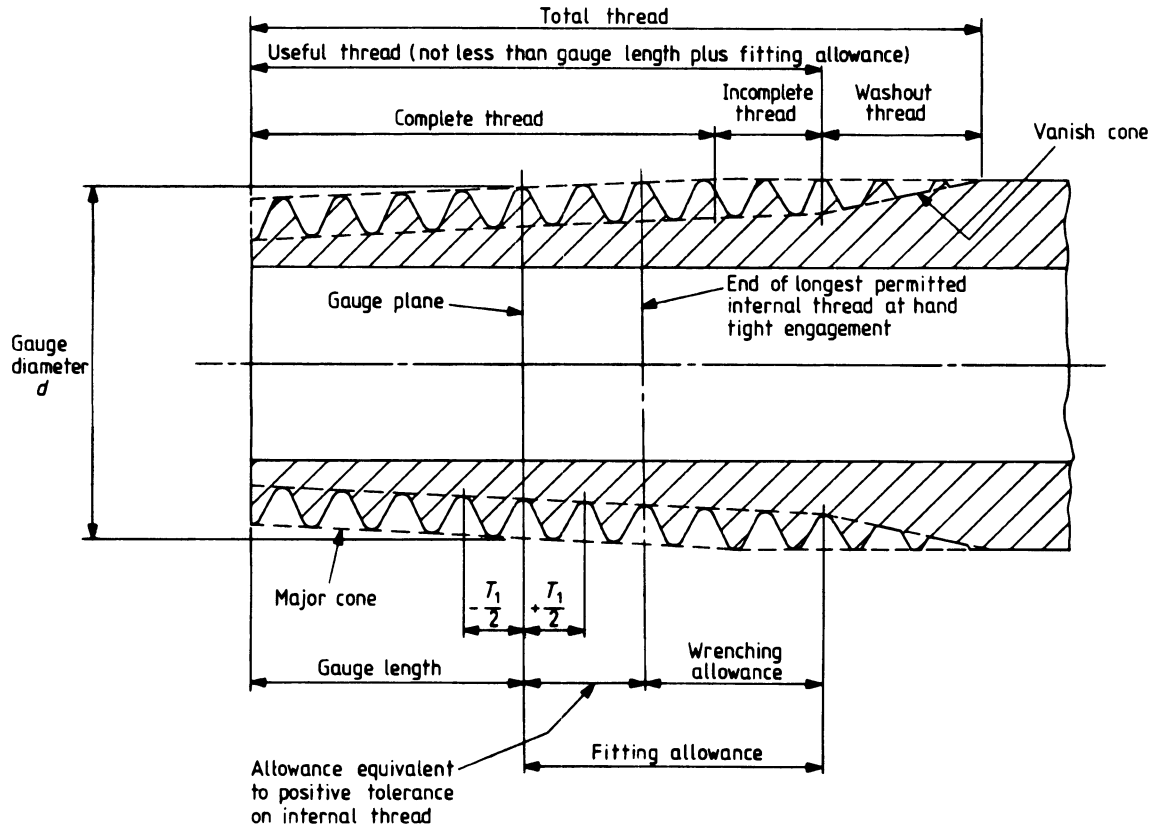
2.2
gauge plane

the plane, perpendicular to the axis, at which the major cone has the gauge diameter

NOTE When there is a chamfer at the start of the thread not exceeding one pitch in length the gauge plane is theoretically located for internal threads at the face of the thread, and for external threads at a distance equal to the basic gauge length from the small end of the thread.

2.3
gauge length

on an external thread, the distance parallel to the axis, from the gauge plane to the small end of the thread



NOTE For symbols see clause **3**.

Figure 1 — Terms relating to pipe threads

2.4
complete thread

that part of the thread which is fully formed at both crest and root

NOTE When there is a chamfer at the start of the thread not exceeding one pitch in length, it is included in the length of complete thread.

2.5
incomplete thread

that part of the thread which is fully formed at the root but truncated at the crest by its intersection with the cylindrical surface of the product

2.6
washout thread

that part of the thread which is not fully formed at the root

NOTE The washout thread is produced by the bevel at the start of the threading tool.

2.7
vanish cone

an imaginary cone the surface of which would pass through the roots of the washout thread

2.8
major cone

an imaginary cone which just touches the crests of a taper external thread or the roots of a taper internal thread

2.9
useful thread

the complete thread and the incomplete thread, excluding the washout thread

2.10
total thread

the complete thread, the incomplete thread and the washout thread

2.11
fitting allowance

the length of useful thread beyond the gauge plane of an external thread required to provide for assembly with an internal thread at the upper limit of the tolerance

2.12
wrenching allowance

the length of useful thread which is provided to accommodate the relative movement between the pipe end and the internally threaded part required for wrenching beyond the position of hand engagement

3 Symbols

For the purposes of this British Standard, the following symbols apply.

Symbol	Term
H	Height of the triangle of the thread profile perpendicular to the thread axis
h	Height of the thread profile between rounded crests and roots perpendicular to the thread axis
r	Radius of rounded crests and roots
p	Pitch
d	Gauge diameter (basic major diameter) of the thread at the gauge plane
d_1	Basic minor diameter of the thread at the gauge plane ($d_1 = d - 1.280\ 654p$)
d_2	Basic pitch diameter of the thread at the gauge plane ($d_2 = d - 0.640\ 327p$)
T_1	Tolerance on the position of the gauge plane on external threads (see Figure 1)
T_2	Tolerance on the position of the gauge plane relative to the face of internally tapered threads

NOTE Additional symbols are used in Table 1, Table 3, Table 4 and Table 5; these are not defined because they are for reference purposes only when used in conjunction with Figure 4, Figure 7, Figure 8, Figure 9, Figure 10, Figure 11 and Figure 12.

4 Basic forms of pipe threads

4.1 Parallel threads

The basic form of the parallel internal pipe thread and of the parallel external longscrew thread shall be the basic Whitworth form as follows.

The Whitworth thread form (see Figure 2) is that of a symmetrical V-thread in which the angle between the flanks, measured in an axial plane section, is 55°; one-sixth of this sharp V is truncated at the top and the bottom, the threads being rounded equally at crests and roots by circular arcs blending tangentially with the flanks, the theoretical depth of thread being 0.640 327 times the nominal pitch. The basic thread depth, calculated from this, is rounded off to the nearest 0.001 mm.

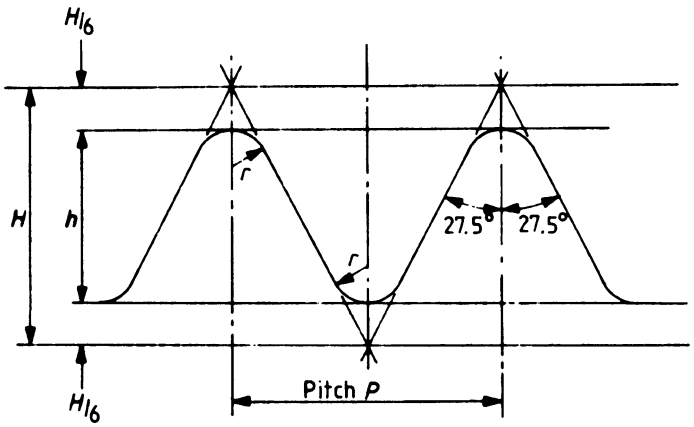


Figure 2 — Basic Whitworth form

4.2 Taper threads

The basic form of the taper pipe thread shall be as follows (see Figure 3).

It is based on the Whitworth thread form and it too has an angle of 55°, the flanks making equal angles with the axis. The crests and roots are rounded off symmetrically in such a manner as to give the same basic differences between major, pitch and minor diameters as in the Whitworth thread of the same nominal pitch.

The taper is 1 in 16, measured on the diameter.

5 Jointing threads

5.1 General

The design of internally threaded parts (see Figure 4) shall be such that they can receive pipe ends up to the lengths given in column 13 of Table 2 and the minimum lengths of useful thread shall be not less than 80 % of the values given in column 14 of Table 2.

NOTE It is common practice to apply a jointing medium to the threads before assembly to ensure that a pressure-tight joint is made.

5.2 Compliance

NOTE No method is specified for verification of jointing thread dimensions and form but the methods described in Appendix B, using the gauging systems described in Appendix A, are recommended.

If tested in accordance with Appendix A and Appendix B, the threads shall be deemed to comply with this standard if they are in accordance with the following.

a) For system A:

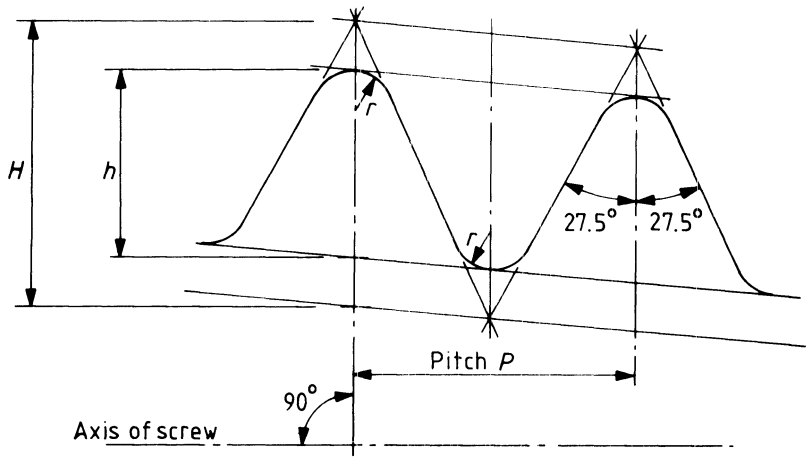
1) when gauging taper external pipe threads with the taper full-form screw ring gauge, the small end of the thread shall lie within the plus and minus tolerance $T_1/2$ (column 9 of Table 2) of the face of the small end of the ring gauge (see Figure 5);

2) when gauging taper or parallel internal pipe threads with the taper full-form screw plug gauge, the end of the thread shall lie within the plus and minus tolerance $T_2/2$ (column 17 of Table 2) from the gauge plane step of the plug gauge (see Figure 5).

b) For system B:

1) when gauging taper external pipe threads with the taper full-form screw ring gauge or with the taper plain ring gauge, the small end of the thread shall lie between the faces or flush with either face of the step on the gauge (see Figure 6);

2) when gauging taper or parallel internal pipe threads with the taper full-form screw plug gauge or with the taper plain plug gauge, the end of the thread shall lie between the faces or flush with either face of the step on the gauge (see Figure 6).



$H = 0.960\,237P$
$h = 0.640\,327P$
$r = 0.137\,278P$

NOTE The taper is 1 in 16 measured on the diameter (shown exaggerated in the diagram).

Figure 3 — Basic form of taper pipe thread

5.3 Parallel internal pipe threads

5.3.1 *Dimensions and tolerances.* The basic diameters of parallel internal threads shall be as given in columns 5, 6, and 7 of Table 2 and the tolerances shall be as given in column 18 of Table 2.

5.3.2 *Designation.* Parallel internal threads shall be designated by the letters R_P, together with the thread size.

These screw threads shall be referred to on drawings and related documents in the following manner:

R_P½

5.4 Taper external and taper internal pipe threads

5.4.1 *Dimensions and tolerances.* The dimensions and tolerances of taper external threads shall be as given in Table 2. The basic diameters of taper internal threads shall be as given in columns 5, 6 and 7 of Table 2 and the tolerances shall be as given in column 17 of Table 2.

5.4.2 *Designation*. Taper external pipe threads shall be designated by the letter R and taper internal threads by the letter $R_{C,}$ together with the thread size.

These screw threads shall be referred to on drawings and related documents in the following manner:

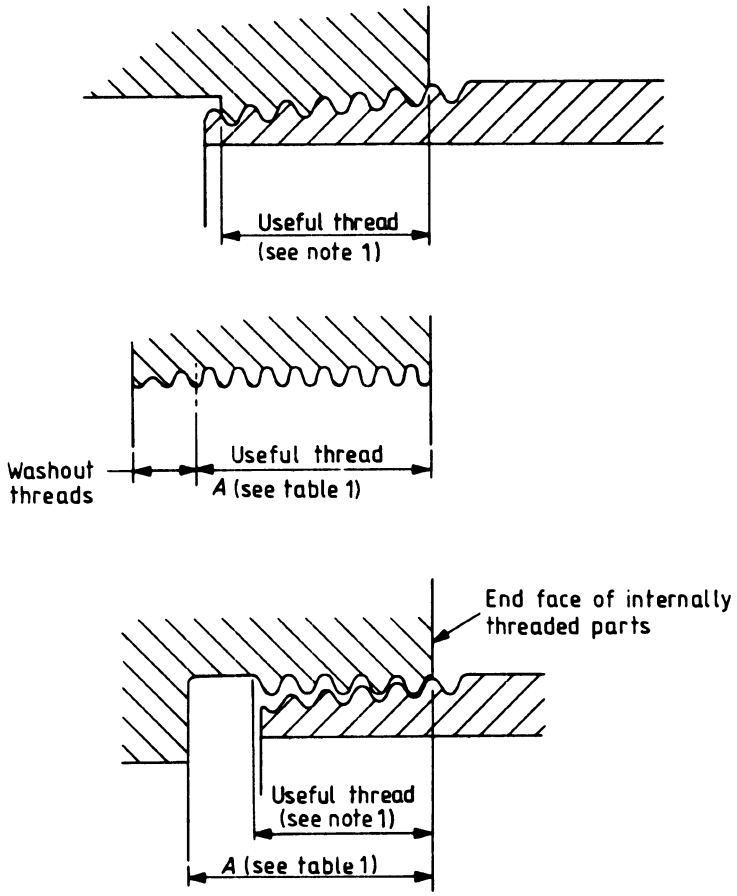
external taper: R½

internal taper: R_C½

6 Longscrew threads

6.1 General

Longscrew threads shall be as specified in **6.2** and **6.3** except for longscrew threads for gas appliances where pressure-tight seals are made on machined faces, where special longscrew threads shall be used as specified in Appendix C.



NOTE 1 The useful thread of the internally threaded part is to be not less than 80 % of the length given in column 14 of Table 2.
NOTE 2 The taper is shown exaggerated in the diagrams.

Figure 4 — Typical designs illustrating internal taper or parallel pipe threads complying with 5.1

Table 1 — Lengths for dimension *A* in Figure 4

Thread size designation	Minimum lengths *A* in turns of thread (see note) for:		
	Internal thread with extreme plus tolerance (maximum diameter)	Internal thread of basic size (gauge diameter)	Internal thread with extreme minus tolerance (minimum diameter)
	(mm)	(mm)	(mm)
1/16	8 1/8 (7.4)	6 7/8 (6.2)	5 5/8 (5.1)
1/8	8 1/8 (7.4)	6 7/8 (6.2)	5 5/8 (5.1)
1/4	8 1/4 (11.0)	7 (9.3)	5 3/4 (7.7)
3/8	8 1/2 (11.4)	7 1/4 (9.7)	6 (8.0)
1/2	8 1/4 (15.0)	7 (12.7)	5 3/4 (10.4)
3/4	9 (16.3)	7 3/4 (14.1)	6 1/2 (11.7)
1	8 1/4 (19.0)	7 (16.2)	5 3/4 (13.3)
1 1/4	9 1/4 (21.4)	8 (18.5)	6 3/4 (15.6)
1 1/2	9 1/4 (21.4)	8 (18.5)	6 3/4 (15.6)
2	11 1/8 (25.7)	9 7/8 (22.8)	8 5/8 (19.9)
2 1/2	13 1/16 (30.1)	11 9/16 (26.7)	10 1/16 (23.2)
3	14 7/16 (33.3)	12 15/16 (29.9)	11 7/16 (26.4)
4	17 (39.3)	15 1/2 (35.6)	14 (32.3)
5	18 7/8 (43.6)	17 3/8 (40.1)	15 7/8 (36.6)
6	18 7/8 (43.6)	17 3/8 (40.1)	15 7/8 (36.6)

NOTE Linear values are given in parentheses and are rounded to 0.1 mm.

6.2 Dimensions and tolerances

The basic diameters of the longscrew threads shall be as given in columns 5, 6 and 7 of Table 2.

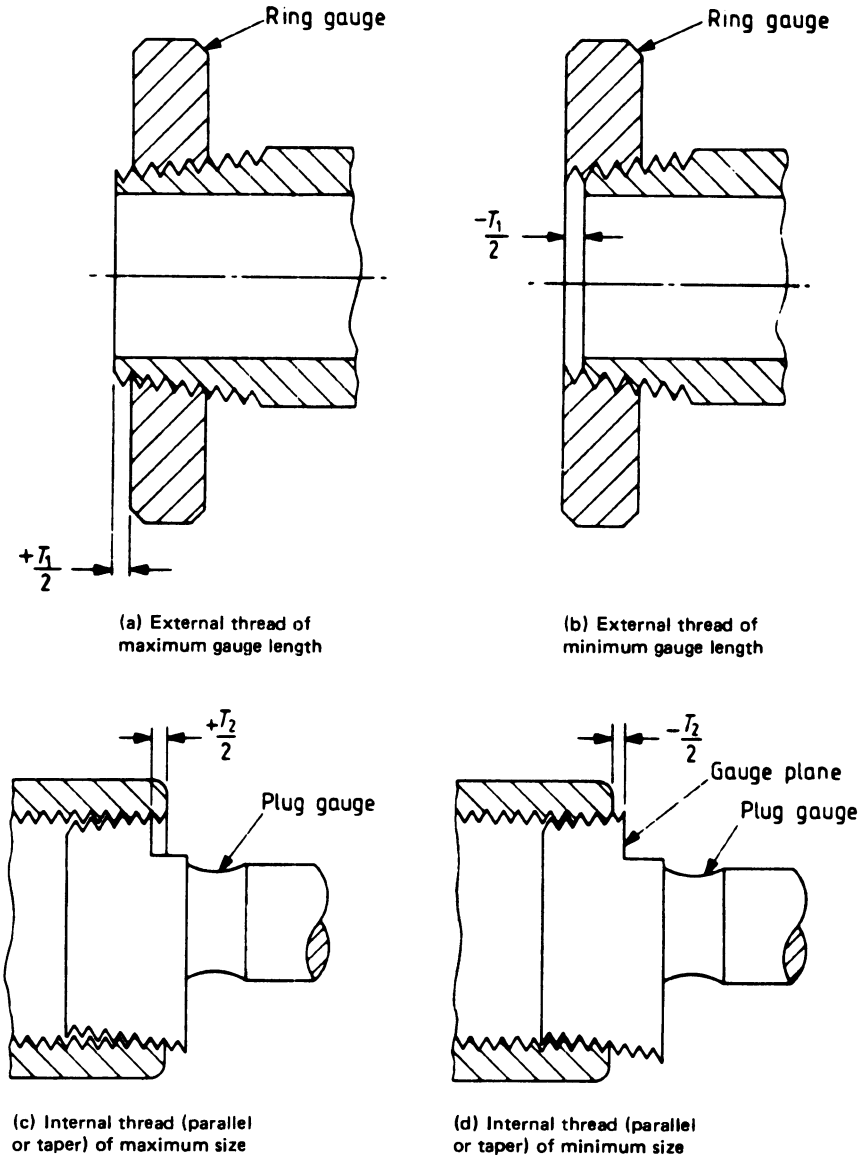
The parallel external threads on the longscrews shall be of such size that the socket and backnut (threaded in accordance with the requirements of **5.3.1**) will run on the longscrew hand-tight without perceptible shake (see note).

NOTE It is not possible to lay down any practicable tolerances for the threads of such longscrews and it is necessary therefore to select the components for assembly. To ensure this requirement being met, the selected components should always be used together.

6.3 Designation

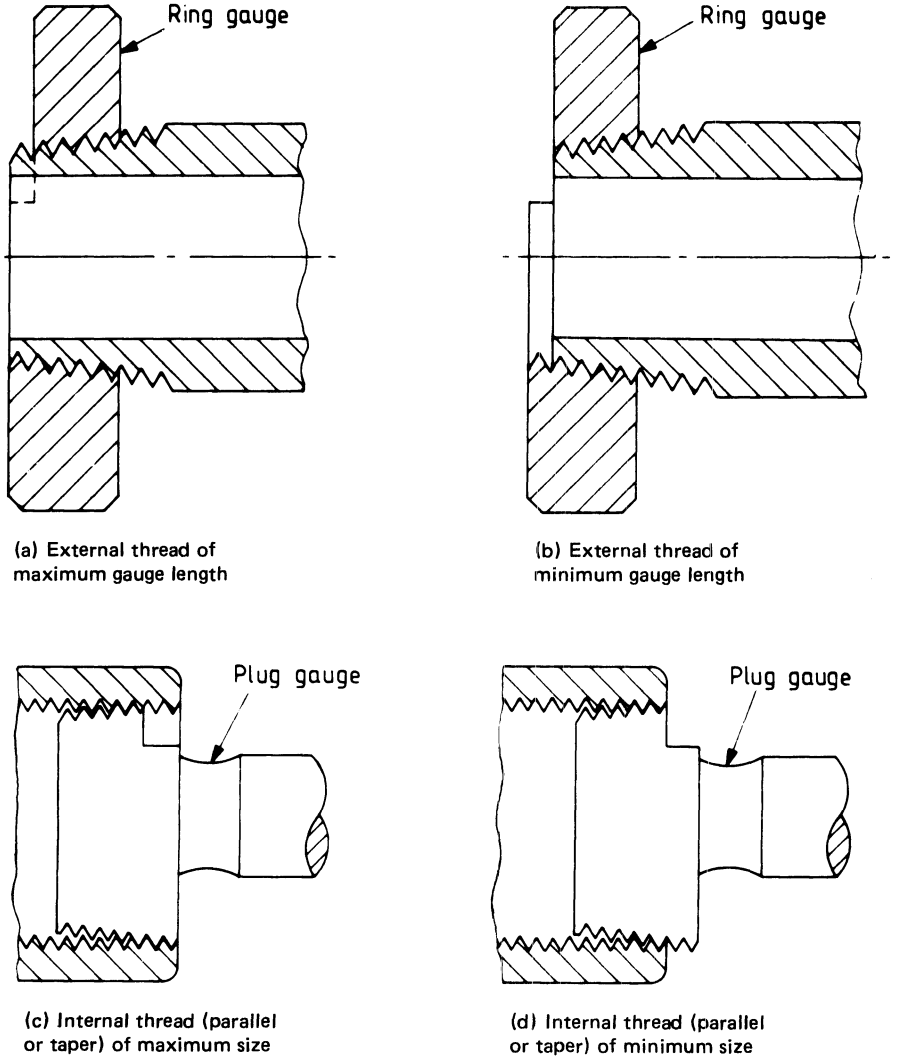
Longscrew threads shall be designated by the letters R_L, together with the thread size. These screw threads shall be referred to on drawings and related documents in the following manner:

R_L½



NOTE 1 It is the parallel thread which is illustrated in (c) and (d).
NOTE 2 The taper of the gauge is shown exaggerated in the diagrams.
NOTE 3 Values of $T_1/2$ are given in column 9 of Table 2, values of $T_2/2$ are given in column 17 of Table 2.
NOTE 4 The taper screw plug gauges are used in a similar manner for gauging internal taper threads.

Figure 5 — System A screw gauges assembled respectively with threads of maximum and minimum sizes



NOTE 1 It is the parallel thread which is illustrated in (c) and (d).
NOTE 2 The taper of the gauge is shown exaggerated in the diagram.
NOTE 3 The taper plain plug and plain ring gauges are used in a similar manner to that illustrated for screw plug and ring gauges.
NOTE 4 The taper screw plug gauges are used in a similar manner for gauging internal taper threads.

Figure 6 — System B screw gauges assembled respectively with threads of maximum and minimum sizes

Table 2 — Basic dimensions and limits of size

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Thread size designation	**Number of threads in 25.4 mm**	**Pitch, P**	**Depth of thread, h**	**Basic diameters at gauge plane**			**Gauge length** (see note 1)				**Minimum length of useful thread on pipe end** (see note 1)			**Fitting allowance** (see note 1)	**Wrenching allowance** (see note 1)	**Tolerance on position of gauge plane relative to face of internally threaded parts** $T_2/2$ (see note 1)	**Diametral tolerance on parallel internal threads**
				Major (gauge diameter), d	**Pitch, d_2**	**Minor, d_1**	**Basic**	**Tolerance** $T_1/2$	**Maximum**	**Minimum**	**Basic gauge length**	**Maximum gauge length** (see 5.1)	**Minimum gauge length** (see 5.1)				
		mm	mm	mm	mm	mm	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	mm
1/16	28	0.907	0.581	7.723	7.142	6.561	4 3/8 (4.0)	±1 (±0.9)	5 3/8 (4.9)	3 3/8 (3.1)	7 1/8 (6.5)	8 1/8 (7.4)	6 1/8 (5.6)	2 3/4 (2.5)	1 1/2 (1.4)	±1 1/4 (±1.1)	±0.071
1/8	28	0.907	0.581	9.728	9.147	8.566	4 3/8 (4.0)	±1 (±0.9)	5 3/8 (4.9)	3 3/8 (3.1)	7 1/8 (6.5)	8 1/8 (7.4)	6 1/8 (5.6)	2 3/4 (2.5)	1 1/2 (1.4)	±1 1/4 (±1.1)	±0.071
1/4	19	1.337	0.856	13.157	12.301	11.445	4 1/2 (6.0)	±1 (±1.3)	5 1/2 (7.3)	3 1/2 (4.7)	7 1/4 (9.7)	8 1/4 (11.0)	6 1/4 (8.4)	2 3/4 (3.7)	1 1/2 (2.0)	±1 1/4 (±1.7)	±0.104
3/8	19	1.337	0.856	16.662	15.806	14.950	4 3/4 (6.4)	±1 (±1.3)	5 3/4 (7.7)	3 3/4 (5.1)	7 1/2 (10.1)	8 1/2 (11.4)	6 1/2 (8.8)	2 3/4 (3.7)	1 1/2 (2.0)	±1 1/4 (±1.7)	±0.104
1/2	14	1.814	1.162	20.955	19.793	18.631	4 1/2 (8.2)	±1 (±1.8)	5 1/2 (10.0)	3 1/2 (6.4)	7 1/4 (13.2)	8 1/4 (15.0)	6 1/4 (11.4)	2 3/4 (5.0)	1 1/2 (2.7)	±1 1/4 (±2.3)	±0.142
3/4	14	1.814	1.162	26.441	25.279	24.117	5 1/4 (9.5)	±1 (±1.8)	6 1/4 (11.3)	4 1/4 (7.7)	8 (14.5)	9 (16.3)	7 (12.7)	2 3/4 (5.0)	1 1/2 (2.7)	±1 1/4 (±2.3)	±0.142
1	11	2.309	1.479	33.249	31.770	30.291	4 1/2 (10.4)	±1 (±2.3)	5 1/2 (12.7)	3 1/2 (8.1)	7 1/4 (16.8)	8 1/4 (19.1)	6 1/4 (14.5)	2 3/4 (6.4)	1 1/2 (3.5)	±1 1/4 (±2.9)	±0.180
1 1/4	11	2.309	1.479	41.910	40.431	38.952	5 1/2 (12.7)	±1 (±2.3)	6 1/2 (15.0)	4 1/2 (10.4)	8 1/4 (19.1)	9 1/4 (21.4)	7 1/4 (16.8)	2 3/4 (6.4)	1 1/2 (3.5)	±1 1/4 (±2.9)	±0.180
1 1/2	11	2.309	1.479	47.803	46.324	44.845	5 1/2 (12.7)	±1 (±2.3)	6 1/2 (15.0)	4 1/2 (10.4)	8 1/4 (19.1)	9 1/4 (21.4)	7 1/4 (16.8)	2 3/4 (6.4)	1 1/2 (3.5)	±1 1/4 (±2.9)	±0.180
2	11	2.309	1.479	59.614	58.135	56.656	6 7/8 (15.9)	±1 (±2.3)	7 7/8 (18.2)	5 7/8 (13.6)	10 1/8 (23.4)	11 1/8 (25.7)	9 1/8 (21.1)	3 1/4 (7.5)	2 (4.6)	±1 1/4 (±2.9)	±0.180
2 1/2	11	2.309	1.479	75.184	73.705	72.226	7 9/16 (17.5)	±1 1/2 (±3.5)	9 1/16 (21.0)	6 1/16 (14.0)	11 9/16 (26.7)	13 1/16 (30.2)	10 1/16 (23.2)	4 (9.2)	2 1/2 (5.8)	±1 1/2 (±3.5)	±0.216
3	11	2.309	1 479	87.884	86.405	84.926	8 15/16 (20.6)	±1 1/2 (±3.5)	10 7/16 (24.1)	7 7/16 (17.1)	12 15/16 (29.8)	14 7/16 (33.3)	11 7/16 (26.3)	4 (9.2)	2 1/2 (5.8)	±1 1/2 (±3.5)	±0.216
4	11	2.309	1.479	113.030	111.551	110.072	11 (25.4)	±1 1/2 (±3.5)	12 1/2 (28.9)	9 1/2 (21.9)	15 1/2 (35.8)	17 (39.3)	14 (32.3)	4 1/2 (10.4)	3 (6.9)	±1 1/2 (±3.5)	±0.216
5	11	2.309	1.479	138.430	136.951	135.472	12 3/8 (28.6)	±1 1/2 (±3.5)	13 7/8 (32.1)	10 7/8 (25.1)	17 3/8 (40.1)	18 7/8 (43.6)	15 7/8 (36.6)	5 (11.5)	3 1/2 (8.1)	±1 1/2 (±3.5)	±0.216
6	11	2.309	1.479	163.830	162.351	160.872	12 3/8 (28.6)	±1 1/2 (±3.5)	13 7/8 (32.1)	10 7/8 (25.1)	17 3/8 (40.1)	18 7/8 (43.6)	15 7/8 (36.6)	5 (11.5)	3 1/2 (8.1)	±1 1/2 (±3.5)	±0.216

NOTE 1. Basic guage lengths and limits of size are expressed in turns of threads. Linear equivalents are given in parentheses and are rounded to 0.1 mm. Tolerances and fitting allowance are expressed in number of turns of thread and in millimetres.

NOTE 2. The basic dimensions were converted into millimetres on the basis of 1 in = 25.4 mm, beginning with the number of threads per inch, which determines the pitch P, the formula $h = 0.640\,327P$ (the depth of thread) and the basic major diameter at the gauge plane. Pitch diameter and minor diameter were then compiled by subtracting once or twice respectively the depth of thread h from the basic major diameter.

The basic gauge length, the tolerances and the fitting allowance were directly computed. The remaining lengths given in the table were obtained by subtracting or adding the tolerances or fitting allowance respectively to the basic gauge length.

Appendix A Recommended gauging systems for jointing threads

A.1 General

This appendix gives details of alternative systems of gauging recommended for use in the control of threads intended to comply with the requirements of this standard for jointing threads. Elaborate methods of inspection are not regarded as necessary or even practicable. It is considered that under appropriate conditions, gauging by either of the recommended systems, coupled with visual inspection, will suffice to ensure satisfactory products having threads which will make sound joints and which will comply with this standard. The use of either recommended system is not specified and the recommendations are given only for guidance.

System A is intended for use where additional production control methods are employed to ensure the general accuracy of the threads.

System B is intended for use where the adequacy of production control is not otherwise established.

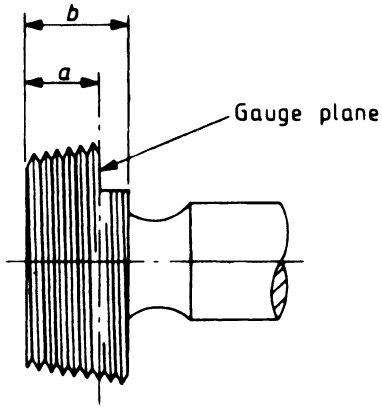
The taper plug gauges in systems A and B may be used for gauging both taper and parallel internal pipe threads.

A.2 System A

A.2.1 *Description of gauges*

System A comprises the following types of gauges.

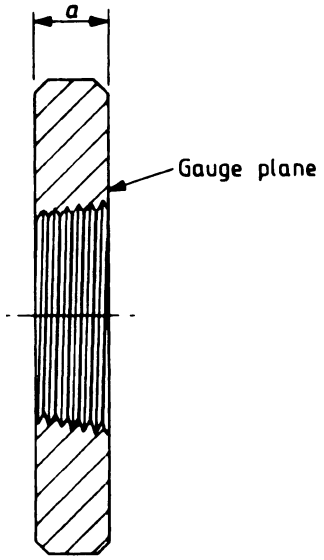
a) A taper full-form screw plug gauge (see Figure 7). This gauge has a step at the gauge plane; the length of the thread from the gauge plane step to the small end of the plug is equal to the basic gauge length. The length of the thread from this gauge plane step to the large end is approximately 3 pitches.



NOTE See Table 3 for dimensions.

Figure 7 — Taper full-form screw plug gauge (system A)

b) A taper full-form screw ring gauge (see Figure 8). This gauge has a length of thread equal to the basic gauge length and the large end diameters are equal to the basic diameters at the gauge plane.



NOTE See Table 3 for dimensions.

Figure 8 — Taper full-form screw ring gauge (system A)

A.2.2 *Dimensions and tolerances*

The dimensions for gauges in system A are given in Table 3 and the tolerances for gauges are given in Table 5.

A.3 System B

A.3.1 *Description of gauges*

System B comprises the following types of gauges.

a) A taper full-form screw plug gauge (see Figure 9). This gauge has a total length of thread equal to the length of useful thread for maximum gauge length, and incorporates a step equal to the total tolerance on the position of the gauge plane. The upper face of the step is marked positive (+) and the lower face is marked negative (–).

NOTE Because of the necessity to remove incomplete threads, it is recommended that the taper full-form screw plug gauges be extended at the large diameter end by an amount equal to three pitches beyond the gauge plane. This will require an additional step to indicate useful thread length at maximum gauge length, marked positive (+).

Table 3 — Dimensions of taper full-form screw plug and ring gauges for system A

1	2	3	4	5	6	7
Thread size designation	Basic diameters at gauge plane			Taper screw plug gauge		Taper screw ring gauge
	Major	Pitch	Minor	Small end of plug to gauge plane step, *a*	Overall length of thread, *b*	Overall length of gauge, *a*
	mm	mm	mm	mm	mm	mm
1/16	7.723	7.142	6.561	4.0	6.6	4.0
1/8	9.728	9.147	8.566	4.0	6.6	4.0
1/4	13.157	12.301	11.445	6.0	9.9	6.0
3/8	16.662	15.806	14.950	6.4	10.4	6.4
1/2	20.955	19.793	18.631	8.2	13.7	8.2
3/4	26.441	25.279	24.117	9.5	15.0	9.5
1	33.249	31.770	30.291	10.4	17.3	10.4
1 1/4	41.910	40.431	38.952	12.7	19.6	12.7
1 1/2	47.803	46.324	44.845	12.7	19.6	12.7
2	59.614	58.135	56.656	15.9	22.9	15.9
2 1/2	75.184	73.705	72.226	17.5	24.4	17.5
3	87.884	86.405	84.926	20.6	27.7	20.6
4	113.030	111.551	110.072	25.4	32.3	25.4
5	138.430	136.951	135.472	28.6	35.6	28.6
6	163.830	162.351	160.872	28.6	35.6	28.6

NOTE 1 For gauge tolerances, see Table 5. For illustration of gauges, see Figure 7 and Figure 8.
NOTE 2 The taper is 1 in 16 measured on diameter.

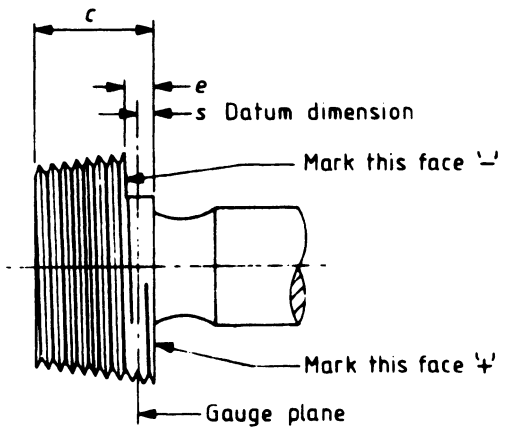
b) A taper full-form screw ring gauge (see Figure 10). This gauge has a total length of thread equal to the length of useful thread for maximum gauge length minus half the wrenching allowance, and incorporates a step equal to the total tolerance on the gauge length. The upper face of the step is marked positive (+) and the lower face is marked negative (–).

c) A taper plain plug gauge (see Figure 11). This gauge has an overall length equal to the fitting allowance plus 0.75 times the total tolerance on the position of the gauge plane, and incorporates a step equal to 1.25 times the total tolerance on the position of the gauge plane. The distance *k* from the gauge plane to the upper face of the step is equal to 1.5 times the positive tolerance on the internal thread (column 17 of Table 2). The upper face of the step is marked positive (+) and the lower face is marked negative (–), but this marking may be omitted where space does not allow for it. The gauge will accept internal threads having small errors of taper and thread depth.

d) A taper plain ring gauge (see Figure 12). This gauge has an overall length equal to the length of useful thread for maximum gauge length minus half the wrenching allowance. It incorporates a step at the small end of the taper equal to 1.25 times the total tolerance on the gauge length and having the upper face marked positive (+) and the lower face marked negative (–). The distance *m* from the gauge plane to the upper face of the step is equal to the minimum gauge length plus the height of the step. The gauge is recessed at the small end to a distance representing the negative (–) tolerance for an internal thread measured from the gauge plane. This gauge will accept external threads having small errors of taper and thread depth.

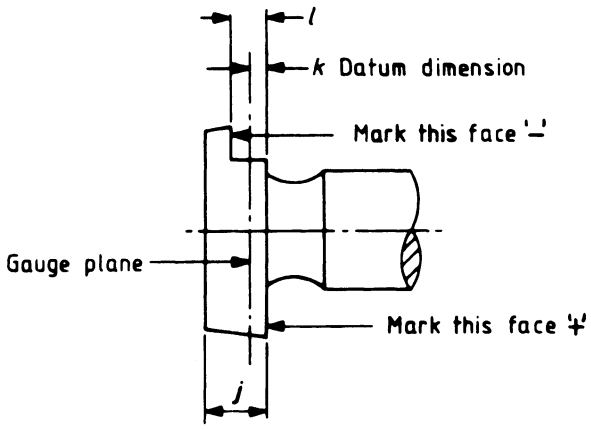
A.3.2 *Dimensions and tolerances*

The dimensions for gauges in system B are given in Table 4 and the tolerances for gauges are given in Table 5.



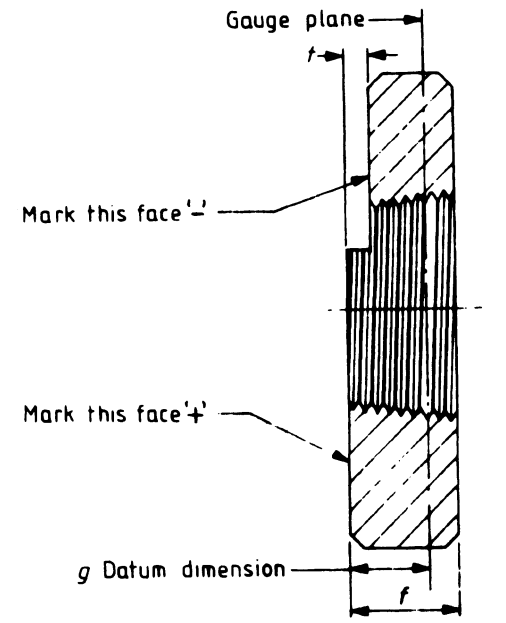
NOTE See Table 4 for dimensions.

Figure 9 — Taper full-form screw plug gauge (system B)



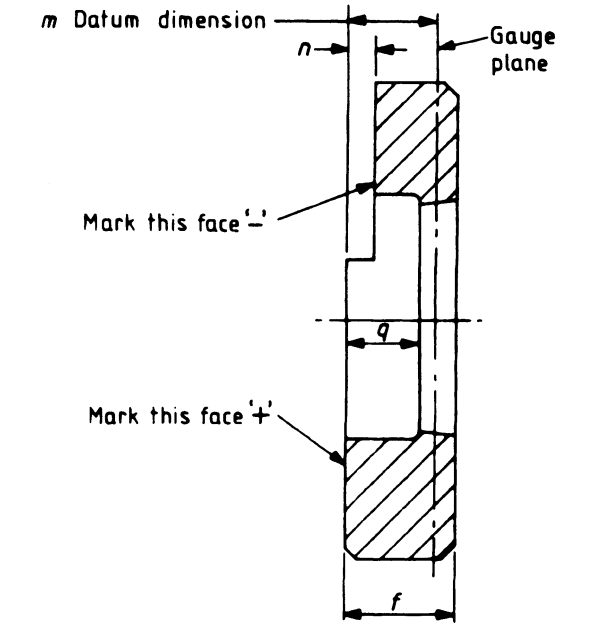
NOTE See Table 4 for dimensions.

Figure 11 — Taper plain plug gauge (system B)



NOTE See Table 4 for dimensions.

Figure 10 — Taper full-form screw ring gauge (system B)



NOTE See Table 4 for dimensions.

Figure 12 — Taper plain ring gauge (system B)

Table 4 — Dimensions of taper full-form screw and taper plain plug and ring gauges for system B

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Thread size designation	**Basic diameters at gauge plane**			**Taper screw plug gauge**			**Taper screw ring gauge**			**Taper plain plug gauge** (see note 3)			**Taper plain ring gauge** (see note 4)			
	Major	**Pitch**	**Minor**	**Overall length of thread,** *c*	**Gauge plane to + face datum,** *s*	**Depth of step,** *e*	**Overall length of thread,** *f*	**Gauge plane to + face datum,** *g*	**Depth of step,** *t*	**Overall length,** *j*	**Gauge plane to + face datum,** *k*	**Depth of step,** *l*	**Overall length,** *f*	**Gauge plane to + face datum,** *m*	**Depth of step,** *n*	**Depth of counter-bore,** *G*
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
1/16	7.723	7.142	6.561	7.4	1.1	2.2	6.7	4.9	1.8	4.2	1.6	2.8	6.7	5.3	2.2	4.2
1/8	9.728	9.147	8.566	7.4	1.1	2.2	6.7	4.9	1.8	4.2	1.6	2.8	6.7	5.3	2.2	4.2
1/4	13.157	12.301	11.445	11.0	1.7	3.4	10.0	7.3	2.6	6.2	2.5	4.2	10.0	8.0	3.2	6.3
3/8	16.662	15.806	14.950	11.4	1.7	3.4	10.4	7.7	2.6	6.2	2.5	4.2	10.4	8.4	3.2	6.7
1/2	20.955	19.793	18.631	15.0	2.3	4.6	13.6	10.0	3.6	8.4	3.4	5.7	13.6	10.9	4.5	8.6
3/4	26.441	25.279	24.117	16.3	2.3	4.6	15.0	11.3	3.6	8.4	3.4	5.7	15.0	12.2	4.5	9.9
1	33.249	31.770	30.291	19.1	2.9	5.8	17.3	12.7	4.6	10.7	4.3	7.2	17.3	13.8	5.8	10.9
1 1/4	41.910	40.431	38.952	21.4	2.9	5.8	19.6	15.0	4.6	10.7	4.3	7.2	19.6	16.2	5.8	13.3
1 1/2	47.803	46.324	44.845	21.4	2.9	5.8	19.6	15.0	4.6	10.7	4.3	7.2	19.6	16.2	5.8	13.3
2	59.614	58.135	56.656	25.7	2.9	5.8	23.4	18.2	4.6	11.8	4.3	7.2	23.4	19.3	5.8	16.4
2 1/2	75.184	73.705	72.226	30.2	3.5	7.0	27.3	21.0	7.0	14.4	5.2	8.7	27.3	22.7	8.7	19.2
3	87.884	86.405	84.926	33.3	3.5	7.0	30.4	24.1	7.0	14.4	5.2	8.7	30.4	25.8	8.7	22.3
4	113.030	111.551	110.072	39.3	3.5	7.0	35.8	28.9	7.0	15.6	5.2	8.7	35.8	30.6	8.7	27.1
5	138.430	136.951	135.472	43.6	3.5	7.0	39.5	32.1	7.0	16.7	5.2	8.7	39.5	33.8	8.7	30.3
6	163.830	162.351	160.872	43.6	3.5	7.0	39.5	32.1	7.0	16.7	5.2	8.7	39.5	33.8	8.7	30.3

NOTE 1 For gauge tolerances, see Table 5. For illustration of gauges, see Figure 9, Figure 10, Figure 11, Figure 12.

NOTE 2 The taper is 1 in 16 measured on diameter.

NOTE 3 Taper plain plug gauge: the basic diameter at the gauge plane is the basic minor diameter of the screw thread (see column 4).

NOTE 4 Taper plain ring gauge: the basic diameter at the gauge plane is the basic major diameter of the screw thread (see column 2).

Table 5 — Manufacturing tolerances for gauges for systems A and B

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Thread size designation	**Number of threads in 25.4 mm**	**Diameter measured at gauge plane**								**Maximum pitch error between any two threads** (see note 2)				**Maximum flank angle errors**		**Maximum taper error on diameter over length of taper** (see note 3)				
		Taper screw plug			**Taper screw ring**			**Taper plain plug**	**Taper plain ring**	**Taper screw plug**		**Taper screw ring**		**Taper screw plug**	**Taper screw ring**	**Taper screw plug**	**Taper screw ring**		**Taper plain plug**	**Taper plain ring**
		Figures 7 and 9			**Figures 8 and 10**															
		Major	**Pitch**	**Minor**	**Major**	**Pitch**	**Minor**	**Figure 11**	**Figure 12**	**Figure 7**	**Figure 9**	**Figure 8**	**Figure 10**	**Figures 7 and 9**	**Figures 8 and 10**	**Figures 7 and 9**	**Figure 8**	**Figure 10**	**Figure 11**	**Figure 12**
		µm	µm	µm	µm	µm	µm	µm	µm	µm	µm	µm	µm	minutes	minutes	µm	µm	µm	µm	µm
1/16	28	±10	±5	+5 -13	+15 -8	±8	±13	±5	±8	5	8	8	10	±25	±30	+8	-10	-15	+5	-8
1/8	28	±10	±5	+5 -13	+15 -8	±8	±13	±5	±8	5	8	8	10	±25	±30	+8	-10	-15	+5	-8
1/4	19	±10	±5	+5 -13	+15 -8	±8	±13	±5	±8	5	8	8	10	±20	±25	+10	-13	-18	+8	-10
3/8	19	±10	±5	+5 -13	+15 -8	±8	±13	±5	±8	5	8	8	10	±20	±25	+10	-13	-18	+8	-10
1/2	14	±13	±8	+8 -15	+20 -10	±10	±15	±8	±10	5	8	8	10	±15	±20	+15	-15	-23	+10	-10
3/4	14	±13	±8	+8 -15	+20 -10	±10	±15	±8	±10	5	8	8	10	±15	±20	+15	-15	-23	+10	-10
1	11	±13	±8	+8 -15	+20 -10	±10	±15	±8	±10	8	10	10	15	±10	±15	+20	-20	-30	+13	-13
1 1/4	11	±13	±8	+8 -15	+20 -10	±10	±15	±8	±10	8	10	10	15	±10	±15	+20	-20	-30	+13	-13
1 1/2	11	±13	±8	+8 -15	+20 -10	±10	±15	±8	±10	8	10	10	15	±10	±15	+20	-20	-30	+13	-13
2	11	±13	±8	+8 -15	+20 -10	±10	±15	±8	±10	8	10	10	15	±10	±15	+20	-20	-30	+13	-13
2 1/2	11	±15	±10	+10 -20	+30 -15	±15	±20	±10	±15	10	13	13	15	±10	±15	+20	-25	-38	+15	-15
3	11	±15	±10	+10 -20	+30 -15	±15	±20	±10	±15	10	13	13	15	±10	±15	+25	-25	-38	+15	-15
4	11	±18	±13	+13 -25	+36 -18	±18	±23	±13	±18	10	13	13	15	±10	±15	+25	-25	-38	+15	-15
5	11	±18	±13	+13 -25	+36 -18	±18	±23	±13	±18	10	13	13	15	±10	±15	+25	-25	-38	+15	-15
6	11	±18	±13	+13 -25	+36 -18	±18	±23	±13	±18	10	13	13	15	±10	±15	+25	-25	-38	+15	-15

NOTE 1. Length tolerances (in µm) are as follows:

Dimensions *a, e, t, l* and n $^{+0}_{-25}$ for sizes below 1 (See tables 3 and 4) and $^{+0}_{-50}$ for sizes 1 and above

Dimensions *b, c, f, j* and q $^{+125}_{-0}$ for sizes below 1 (See tables 3 and 4) and $^{+250}_{-0}$ for sizes 1 and above.

End faces of plug and ring gauges to be square to the axis of taper to within 0.001 (25.4 + *d*) full indicator movement, measured as close as possible to the screw thread where *d* is the basic major diameter of thread (in mm).

NOTE 2. Maximum allowable error in pitch between any two threads whether adjacent or separated by any amount not exceeding the full length of thread less than one full thread at each end.

NOTE 3. The maximum taper error on diameter over the length of taper of a screw gauge is measured over the full length of thread less one full thread at each end of gauge.

Appendix B Methods of verification of jointing thread dimensions and form using recommended gauging systems described in Appendix A

B.1 System A

B.1.1 *Gauging taper external pipe threads*

Screw the taper full-form screw ring gauge (see Figure 8) hand-tight on to the external thread.

B.1.2 *Gauging taper or parallel internal pipe threads*

Screw the taper full-form screw plug gauge (see Figure 7) hand-tight into the internal thread.

B.2 System B

B.2.1 *Gauging taper external pipe threads*

B.2.1.1 Screw the taper full-form screw ring gauge (see Figure 10) hand-tight on to the external thread.

B.2.1.2 Assemble the taper plain ring gauge (see Figure 12) by hand with the external threads, taking care not to use an excessive amount of force.

B.2.2 *Gauging taper or parallel internal pipe threads*

B.2.2.1 Screw the taper full-form screw plug gauge (see Figure 9) hand-tight into the internal thread.

B.2.2.2 Assemble the taper plain plug gauge (see Figure 11) by hand with the internal thread, taking care not to use an excessive amount of force.

Appendix C Special parallel external threads for gas appliances where pressure-tight seals are made on machined faces

C.1 General

NOTE Parallel internal threads for use with special parallel external threads for gas appliance applications should accept a parallel length of threaded pipe-end in accordance with those lengths given in column 13 of Table 2.

Except when used for stud ends, there shall be at least five threads engagement. The length of threads on stud ends shall comply with the appropriate British Standard.

C.2 Dimensions and tolerances

Dimensions and tolerances for special parallel external threads shall be as given in Table 6.

C.3 Designation

Special parallel external threads for gas appliances where pressure-tight seals are made on machined faces shall be designated by the letters R_S, together with the thread size. These screw threads shall be referred to on drawings and related documents in the following manner:

R_S ½

Table 6 — Special parallel external threads for gas appliances where pressure-tight seals are made on machined faces

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Thread size designation	Number of threads in 25.4 mm	Pitch, *P*	Depth of thread	Major diameter (gauge diameter)				Pitch diameter				Minor diameter		
				Basic	Tolerance	Maximum	Minimum	Basic	Tolerance	Maximum	Minimum	Basic	Tolerance	Maximum
		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
$^1/_8$	28	0.907	0.581	9.728	– 0.089 – 0.284	9.639	9.444	9.147	– 0.089 – 0.196	9.058	8.951	8.566	– 0.089 and over	8.477
$^1/_4$	19	1.337	0.856	13.157	– 0.124 – 0.353	13.033	12.804	12.301	– 0.124 – 0.249	12.177	12.052	11.445	– 0.124 and over	11.321
$^3/_8$	19	1.337	0.856	16.662	– 0.124 – 0.353	16.538	16.309	15.806	– 0.124 – 0.249	15.682	15.557	14.950	– 0.124 and over	14.826
$^1/_2$	14	1.814	1.162	20.955	– 0.168 – 0.427	20.787	20.528	19.793	– 0.168 – 0.310	19.625	19.483	18.631	– 0.168 and over	18.463
$^3/_4$	14	1.814	1.162	26.441	– 0.168 – 0.427	26.273	26.014	25.279	– 0.168 – 0.310	25.11	24.969	24.117	– 0.168 and over	23.949
1	11	2.309	1.479	33.249	– 0.211 – 0.541	33.038	32.708	31.770	– 0.211 – 0.391	31.559	31.379	30.291	– 0.211 and over	30.080
$1^1/_4$	11	2.309	1.479	41.910	– 0.211 – 0.541	41.699	41.369	40.431	– 0.211 – 0.391	40.221	40.040	38.952	– 0.211 and over	38.741
$1^1/_2$	11	2.309	1.479	47.803	– 0.211 – 0.541	47.592	47.262	46.324	– 0.211 – 0.391	46.113	45.933	44.845	– 0.211 and over	44.634
2	11	2.309	1.479	59.614	– 0.211 – 0.541	59.403	59.073	58.135	– 0.211 – 0.391	57.924	57.744	56.656	– 0.211 and over	56.445

NOTE For the gauging of these threads, reference may be made to BS 919-2.

Publications referred to

BS 919, *Screw gauge limits and tolerances.*
BS 919-2, *Gauges for screw threads of Whitworth and BA forms.*
BS 1387, *Steel tubes and tubulars suitable for screwing to BS 21 pipe threads.*
BS 2779, *Pipe threads where pressure-tight joints are not made on the threads.*
ISO 7, *Pipe threads where pressure-tight joints are made on the threads*[1)].
ISO 7-1, *Designation, dimensions and tolerances.*
ISO 7-2, *Verification by means of limit gauges.*

[1)] Referred to in the foreword only.

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