

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

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW



Document Sharing Hub

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

This British Standard, having been prepared under the direction of the Piping Systems Standards Committee, was published under the authority of the Executive Board and comes into effect on 30 September 1985

© BSI 03-1999

First published April 1905
First revision November 1909
Second revision November 1938
Third revision December 1957
Fourth revision March 1973
Fifth revision September 1985

The following BSI references relate to the work on this standard:
Committee reference PSE/9
Draft for comment 83/78475 DC

ISBN 0 580 14556 5

Amendments issued since publication

Amd. No.	Date of issue	Comments
6633	December 1990	Indicated by a sideline in the margin

Contents

	Page
Committees responsible	Inside front cover
Foreword	ii
1 Scope	1
2 Definitions	1
3 Symbols	2
4 Basic forms of pipe threads	2
5 Jointing threads	3
6 Longscrew threads	4
Appendix A Recommended gauging systems for jointing threads	10
Appendix B Methods of verification of jointing thread dimensions and form using recommended gauging systems described in Appendix A	15
Appendix C Special parallel external threads for gas appliances where pressure-tight seals are made on machined faces	15
Figure 1 — Terms relating to pipe threads	1
Figure 2 — Basic Whitworth form	3
Figure 3 — Basic form of taper pipe thread	4
Figure 4 — Typical designs illustrating internal taper or parallel pipe threads complying with 5.1	5
Figure 5 — System A screw gauges assembled respectively with threads of maximum and minimum sizes	7
Figure 6 — System B screw gauges assembled respectively with threads of maximum and minimum sizes	8
Figure 7 — Taper full-form screw plug gauge (system A)	10
Figure 8 — Taper full-form screw ring gauge (system A)	10
Figure 9 — Taper full-form screw plug gauge (system B)	12
Figure 10 — Taper full-form screw ring gauge (system B)	12
Figure 11 — Taper plain plug gauge (system B)	12
Figure 12 — Taper plain ring gauge (system B)	12
Table 1 — Lengths for dimension A in Figure 4	6
Table 2 — Basic dimensions and limits of size	9
Table 3 — Dimensions of taper full-form screw plug and ring gauges for system A	11
Table 4 — Dimensions of taper full-form screw and taper plain plug and ring gauges for system B	13
Table 5 — Manufacturing tolerances for gauges for systems A and B	14
Table 6 — Special parallel external threads for gas appliances where pressure-tight seals are made on machined faces	16
Publications referred to	Inside back cover

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 longcrew 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 $\frac{1}{16}$ 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

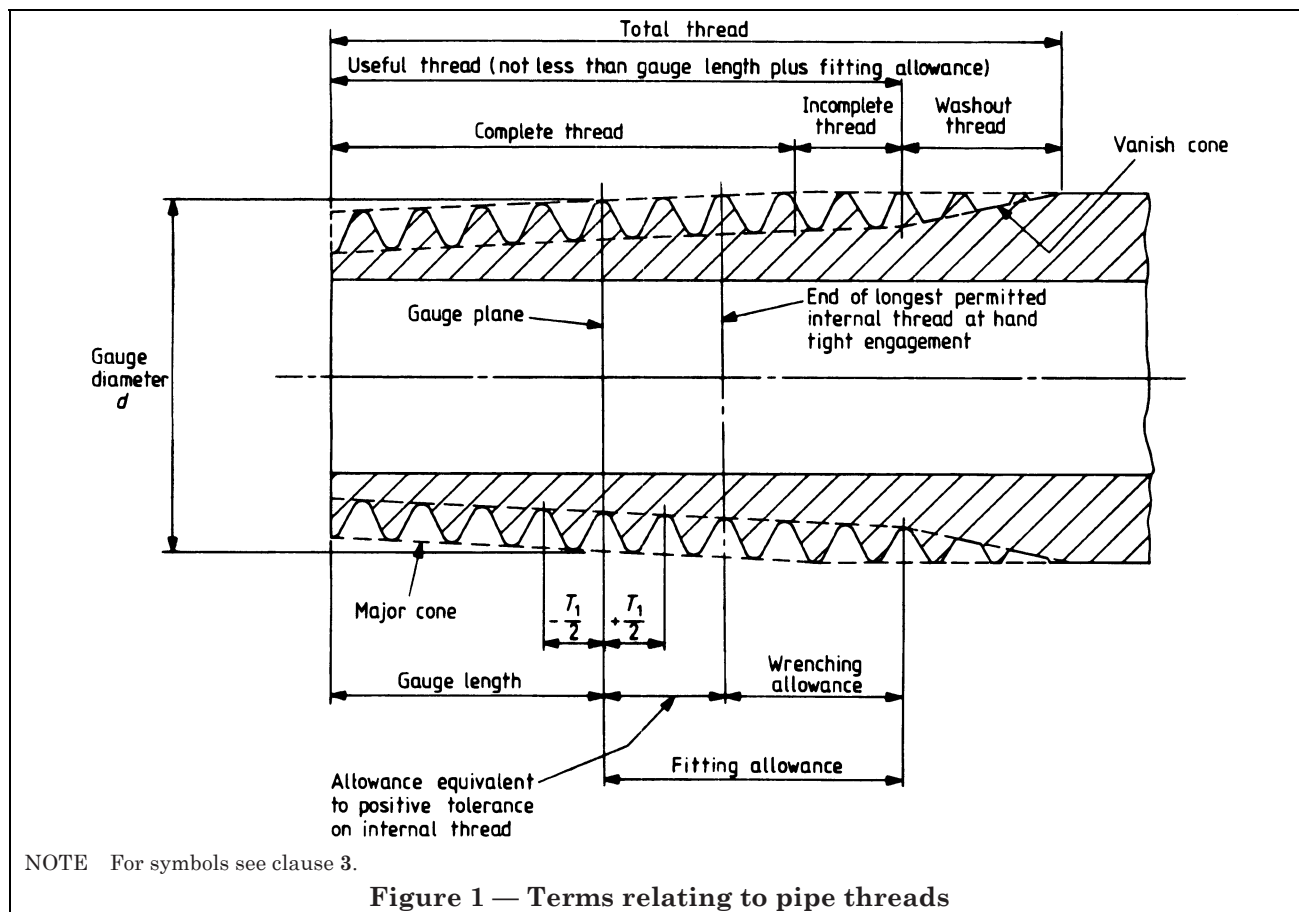
2.2 gauge plane

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



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.

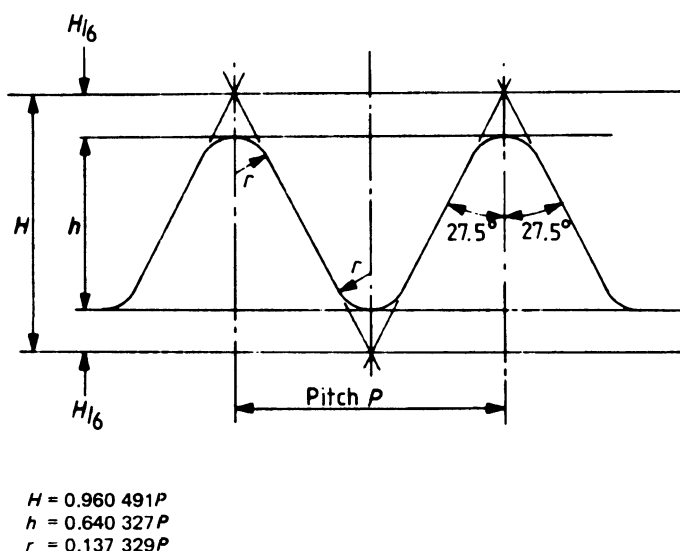


Figure 2 — Basic Whitworth form

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).