

Specification for

General purpose acme screw threads

UDC 621.882.082.4

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW



Document Sharing Hub

Co-operating organizations

The Mechanical Engineering Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:—

Admiralty*	High Commissioner of India
Air Ministry*	Institute of Marine Engineers
Associated Offices' Technical Committee	Institute of Petroleum
Association of Consulting Engineers	Institution of Civil Engineers
(Incorporated)	Institution of Gas Engineers
British Chemical Plant Manufacturers'	Institution of Heating and
Association	Ventilating Engineers
British Compressed Air Society	Institution of Mechanical Engineers*
British Electrical and Allied Manufacturers'	Institution of Mechanical Engineers
Association*	(Automobile Division)
British Engineers' Association*	Institution of Production Engineers*
British Internal Combustion Engine	Locomotive and Allied Manufacturers'
Manufacturers' Association	Association of Great Britain*
British Iron and Steel Federation	Machine Tool Trades Association*
British Railways, The British Transport	Ministry of Power
Commission*	Ministry of Labour and National
Central Electricity Authority and Area Boards	Service (Factory Inspectorate)
Crown Agents for Oversea	Ministry of Supply*
Governments and Administrations	Ministry of Transport and Civil Aviation
D.S.I.R. — Mechanical Engineering	Ministry of Works
Research Laboratory*	National Coal Board
Engineering Equipment Users' Association*	National Physical Laboratory D.S.I.R.*
Gas Council	Radio Industry Council*
	War Office

The organizations marked with an asterisk in the above list, together with the following, were directly represented on the Committee entrusted with the preparation of this standard:—

Agricultural Engineers' Association	Radio Communication and Electronic
British Bolt, Nut, Screw and Rivet Federation	Engineering Association
British Valve Manufacturers' Association	Scientific Instrument Manufacturers'
Cut Thread Screwing Tool	Association
Manufacturers' Association	Society of British Aircraft Constructors
Engineering Standards Co-ordinating	Society of Motor Manufacturers and
Committee	Traders Ltd.
Gauge and Tool Makers' Association	Telecommunication Engineering and
Ground Thread Tap Association	Manufacturing Association
National Association of Marine	
Engine Builders	

This British Standard, having been approved by the Mechanical Engineering Industry Standards Committee and endorsed by the Chairman of the Engineering Divisional Council, was published under the authority of the General Council on 5 June 1957

© BSI 12-1999

First published 1943
First revision June 1957

The following BSI references relate to the work on this standard:
Committee references MEE/1, MEE/1/9
Draft for comment
CW (MEE) 5339

ISBN 0 580 35250 1

Amendments issued since publication

Amd. No.	Date of issue	Comments
5555	July 1965	
5707	December 1965	
5795	March 1966	Indicated by a sideline in the margin

Contents

	Page
Co-operating organizations	Inside front cover
Foreword	iii
Section 1. Specification	
1 Scope	1
2 Definitions	1
3 Basic and design forms of thread	1
4 Nominal sizes	1
5 Basic diameters	1
6 Standard series	1
7 Classes of threads	1
8 Clearances, allowances, tolerances and limiting dimensions	2
9 Length of engagement	2
10 Chamfers	2
11 Special diameters and pitches	2
12 Designations	3
Section 2. Gauging of Acme screw threads	
13 Gauges for screws	18
14 Gauges for nuts	18
15 Concentricity	19
16 Lengths of GO screw gauges	19
17 Tolerances for gauges	20
18 Gauge limits for the standard series of general purpose Acme threads	21
Appendix A	27
Appendix B Effect of pitch and angle errors on effective diameter	32
Figure 1 — Basic and design forms of Acme screw threads	4
Figure 2 — Tolerance zones for general purpose Acme screw and nut	5
Figure 3 — Diametral tolerances, clearances and allowances for the four classes of general purpose Acme threads of 1 in. dia. — 6 T P I	6
Figure 4 — Effective diameter tolerances and allowances for the standard series	7
Table 1 — Basic dimensions of the standard series	8
Table 2 — Basis of limiting dimensions	9
Table 3 — Screws — Class 2G	10
Table 4 — Nuts — Class 2G	11
Table 5 — Screws — Class 3G	12
Table 6 — Nuts — Class 3G	13
Table 7 — Screws — Class 4G	14
Table 8 — Nuts — Class 4G	15
Table 9 — Screws — Class 5G	16
Table 10 — Nuts — Class 5G	17
Table 11 — Recommended lengths of GO screw ring gauges for Acme threads	19
Table 12 — Tolerances for GO and NOT GO screw thread and plain gauges	20
Table 13 — Acme GO screw ring gauges dimensions	22
Table 14 — Acme NOT GO effective diameter screw ring gauges	23
Table 15 — Acme GO screw plug gauges (all classes)	24
Table 16 — Acme NOT GO effective diameter screw plug gauges	25
Table 17 — Acme plain gauges (all classes)	26
Table 18 — Proportions of pitch (p) used in calculating tolerances	27

	Page
Table 19 — Proportions of nominal size (D) used in calculating tolerances and allowances	27
Table 20 — Effective diameter tolerances — Class 2G	28
Table 21 — Effective diameter tolerances — Class 3G	29
Table 22 — Effective diameter tolerances — Class 4G	30
Table 23 — Effective diameter tolerances — Class 5G	31

Foreword

This standard makes reference to the following British Standard:

BS 2517, *Definitions for use in mechanical engineering*.

This British Standard has been prepared under the authority of the Mechanical Engineering Industry Standards Committee and replaces the 1943 edition which was withdrawn when the American Standards Association commenced a revision of their standard on which the British document was based.

Acme screw threads were introduced, prior to 1895, to replace square threads and various threads of other forms used chiefly for the purpose of producing traversing motions on machine tools and for similar applications. The Acme screw thread is now extensively used for a variety of purposes and the need has been established since the 1943 edition for a range of threads for different classes of work.

At the Conference on the Unification of Engineering Standards held in Ottawa in 1945, Great Britain and Canada agreed to recommend the acceptance in their respective countries of the revised American War Standard ASA B1.5:1945 for this screw thread. Subsequently, however, the American Standards Association found it necessary to undertake a revision of ASA B1.5, and in 1952 produced a new standard which contained a Selected Series of diameter/pitch combinations.

While it was possible for the BSI to base this present standard very largely on ASA B1.5:1952, a thorough review of British industrial usage has compelled a departure from the U.S. Standard Series of diameter/pitch combinations in a small number of instances, namely: $\frac{3}{8}$ in., $\frac{7}{16}$ in., 1 in., $1\frac{1}{8}$ in. and $1\frac{1}{4}$ in. diameters. In all other cases the British Standard is in accord with the General Purpose Acme Threads in ASA B1.5:1952 as regards diameters, pitches, limits and tolerances for the three classes of threads common to both standards and designated 2G, 3G and 4G: it will be noted however that an additional Class 5G has been provided in the British Standard.

In Table 20, Table 21, Table 22 and Table 23, effective diameter tolerances for an extended range of diameter/pitch combinations are set out for the four classes of thread covered by the standard. For convenience of reference, the British and American Standard Series have been clearly identified in the first three tables applicable to Class 2G, 3G and 4G threads.

The general purpose threads specified in this standard for classes 2G, 3G and 4G threads have clearance on all diameters for free lateral movement to accommodate possible errors in alignment of the axis of the fixed nut and that of the screw which engages with it. The threads in this standard are not intended for application where centralizing is necessary; such threads do not form part of this standard.

The limits and tolerances in this standard relate to single-start Acme threads, and may be used, if considered suitable, for multi-start Acme threads. The latter threads are employed where single-start threads do not provide the fast relative traversing motion which is sometimes necessary.

The recommended system for gauging the threads is to British principles and practice.

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 to iv, pages 1 to 34 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.

Section 1. Specification of Acme screw thread

1 Scope

This British Standard recommends a Standard Series of diameters and associated pitches for General Purpose Acme form screw threads, for the nominal size range $\frac{1}{4}$ in. to 5 in. and specifies the limiting dimensions, tolerances and allowances for four classes of thread.

Information is also provided whereby the limiting dimensions for any other screw thread of Acme form may be determined, but the use of these special diameter/pitch combinations should be avoided wherever possible.

Recommendations are given in Section 2 regarding the types and dimensions of gauges to be used.

2 Definitions

For the purposes of this British Standard the definitions given in BS 2517, “*Definitions for use in mechanical engineering*”, shall apply. The two definitions which follow are quoted from that standard.

pitch

the distance, measured parallel to the axis, between corresponding points on adjacent thread forms in the same axial plane section and on the same side of the axis

NOTE The pitch (in inches) is the reciprocal of the number of the threads per inch.

lead

the distance, measured parallel to the axis, between corresponding points on consecutive contours of the same thread helix in the same axial plane section and on the same side of the helix

NOTE 1 The lead is the distance the thread advances axially in one revolution.

NOTE 2 For a single-start thread the lead is identical with the pitch. The use of the term lead is normally confined to multi-start threads.

NOTE 3 The lead (in inches) is the reciprocal of the number of turns per inch.

3 Basic and design forms of thread

The basic and design forms of the Acme screw thread are shown in Figure 1. The basic form is symmetrical, and the angle between the flanks, measured in an axial plane, is 29° . The basic depth of thread and the thickness of the thread at the effective diameter are equal to one-half of the pitch.

4 Nominal sizes

The nominal size of the screw thread is the maximum major diameter of the external thread.

5 Basic diameters

The basic diameters are the maximum major diameter of the external thread and the minimum effective diameter and minimum minor diameter of the internal thread (see Figure 2).

6 Standard series

The Standard Series of diameters and associated pitches for General Purpose Acme form screw threads, together with the relevant basic sizes are specified in Table 1.

7 Classes of threads

Four classes of threads are provided designated 2G, 3G, 4G and 5G.

The selection of the class of thread for a particular purpose rests with the designer. It is recommended that screws¹⁾ and nuts¹⁾ of the same class be used together for all normal purposes but where design requirements demand a screw and nut of different classes, this is permissible.

Class 2G. This class is suitable for use where a loose fit is desired to allow free running of the screw even under exposed conditions.

Class 3G. This class is suitable for assemblies in which backlash or end play must not be excessive.

¹⁾ The terms “screws” and “nuts” are used in the general sense to designate external and internal threads respectively.

Class 4G. This class provides for closer mating screw and nut threads. Specification of the Class 4G should be restricted to assemblies where accuracy of pitch and thread form is particularly required, and where only a small amount of backlash or end play can be tolerated.

Class 5G. The above three classes incorporate an allowance on the effective diameter of the screw. This class has no allowance on the effective diameter of the screw and has reduced effective diameter tolerances to provide for assemblies where backlash and end play must be kept to a minimum for certain high precision applications. The clearances on major and minor diameters are the same as for the other classes.

8 Clearances, allowances, tolerances and limiting dimensions

The diametral clearances, allowances and tolerances for the four classes of threads are based on the formulae given in Table 2, and their relative magnitudes and dispositions are illustrated for one size in Figure 3.

Figure 4 shows graphically the effective diameter tolerances and allowances for all four classes.

i) **Clearances.** From Table 2 it will be seen that a minimum clearance is provided between the crests and roots of the mating screws and nuts as follows:—

Nuts. The minimum major diameters specified are 0.020 in. greater than the relevant basic major diameter for threads of 10 t.p.i. and coarser, and 0.010 in. greater for finer pitches.

Screws. The maximum minor diameters specified are 0.020 in. less than the relevant basic minor diameter for threads of 10 t.p.i. and coarser, and 0.010 in. less for finer pitches.

ii) **Allowances.** On all threads except Class 5G threads, an allowance is provided between the minimum effective diameter of the nut (basic size) and the maximum effective diameter of the screw. The allowance is based on the basic major diameter and varies for each class as shown in Table 2 and in Figure 3 and Figure 4.

iii) **Tolerances.** The tolerances on effective diameter are the same for screws as for nuts for a given class. The effective diameter tolerances for Class 4G are derived from the formula $0.010\sqrt{p} + 0.002\sqrt{D}$ where p is the pitch and D the nominal size of the thread. The relationship between the effective diameter tolerances for the four classes 2G, 3G, 4G and 5G is 3.0, 1.4, 1.0, and 0.8 respectively. The tolerances specified for the effective diameter include the diametral equivalents of pitch and angle errors. (See Appendix B.)

iv) **Limiting dimensions.** The limiting dimensions for the Standard Series of diameter/pitch combinations resulting from the formulae of Table 2 are set out in Table 3 to Table 10.

9 Length of engagement

The tolerances specified on effective diameter are suitable for lengths of engagement not exceeding twice the nominal size.

10 Chamfers

External threads may have the crest corners chamfered at an angle of 45° with the axis, to a maximum depth of $p/15$. This corresponds to a maximum width of chamfer of $0.0945 p$. (See Figure 2.)

11 Special diameters and pitches

The limiting dimensions for any special diameter/pitch combinations can be calculated from Table 2 with the aid of Table 18 to Table 23 (Appendix A) which give the required proportions of p and D respectively. The effective diameter tolerances for a limited range of diameter/pitch combinations have been tabulated for convenience in Table 20–Table 23.

It is recommended that special diameters and pitches should only be used in exceptional cases where it is not possible to use the Standard Series. Multi-start threads should be considered when fast relative motion is required.

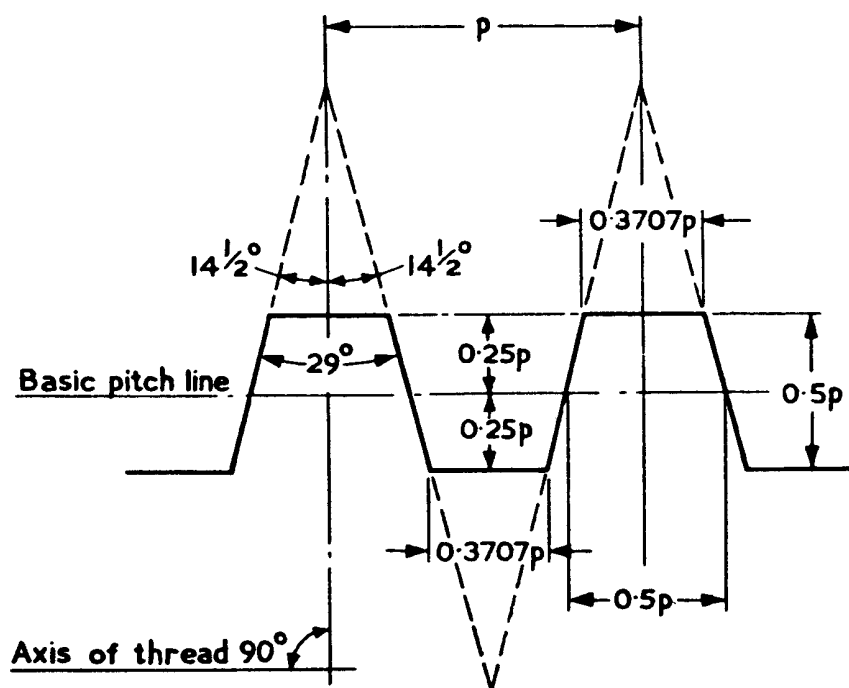
12 Designations

The following are examples of the recommended abbreviations and designations which should be used on drawings and related documents, and on tools and gauges:—

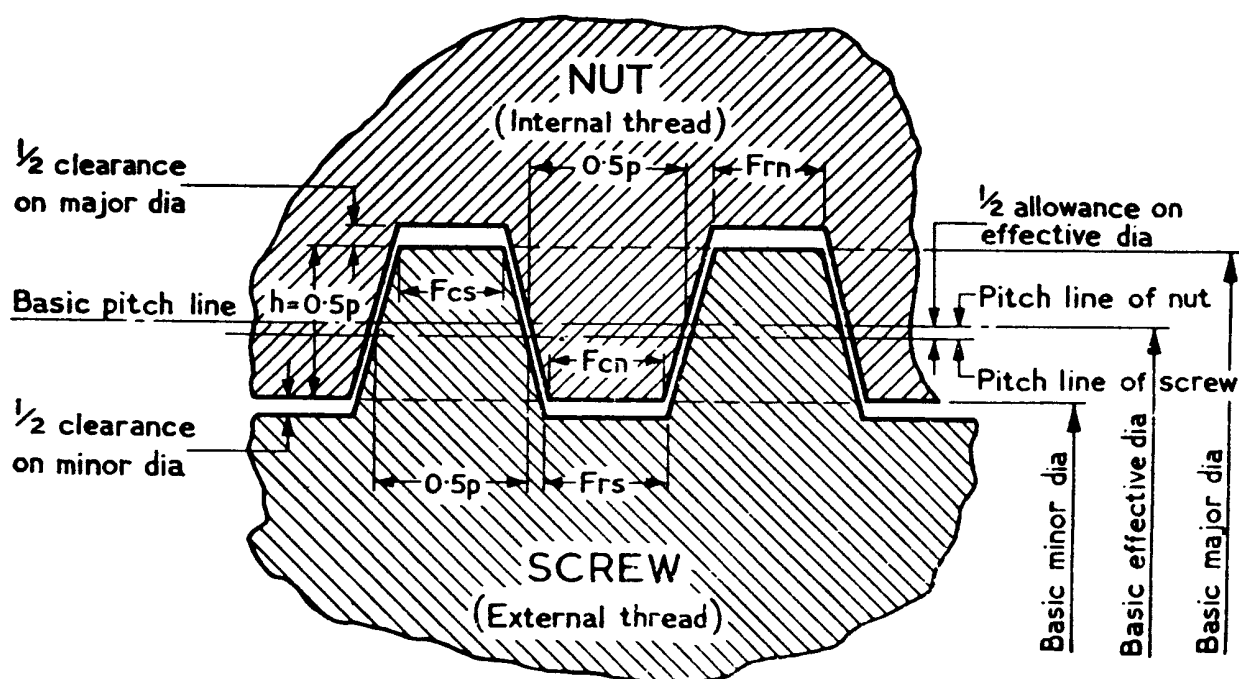
$1\frac{3}{4}$ —4 Acme—2G	Major dia. $1\frac{3}{4}$ in.—4 t.p.i.—single-start, right-hand, General Purpose Acme thread — Class 2G.
$2\frac{7}{8}$ —0.4 <i>p</i> —0.8L—Acme—3G	Major dia. $2\frac{7}{8}$ in.—pitch 0.4 in.—lead 0.8 in.—double-start, right-hand, General Purpose Acme thread —Class 3G.

If the thread is left-hand, the symbol “LH” should be added as follows:—

$1\frac{3}{4}$ —4 Acme—2G—LH	Left-hand Acme Threads.
$2\frac{7}{8}$ —0.4 <i>p</i> —0.8L—Acme—3G—LH	



Basic form of Acme thread (theoretical).



- p = pitch.
 $h = 0.5 p$ = Depth of engagement.
 $F_{cn} = 0.3707 p$ = Design width of flat at crest of nut.
 $F_{cs} = 0.3707 p - 0.259 \times (\text{Effective dia. allowance on screw}).$
 $F_{rn} = 0.3707 p - 0.259 \times (\text{Major dia. clearance on nut}).$
 $F_{rs} = 0.3707 p - 0.259 \times (\text{Minor dia. clearance on screw} - \text{effective dia. allowance on screw}).$

Design forms of Acme threads
(Maximum metal condition)

Figure 1 — Basic and design forms of Acme screw threads

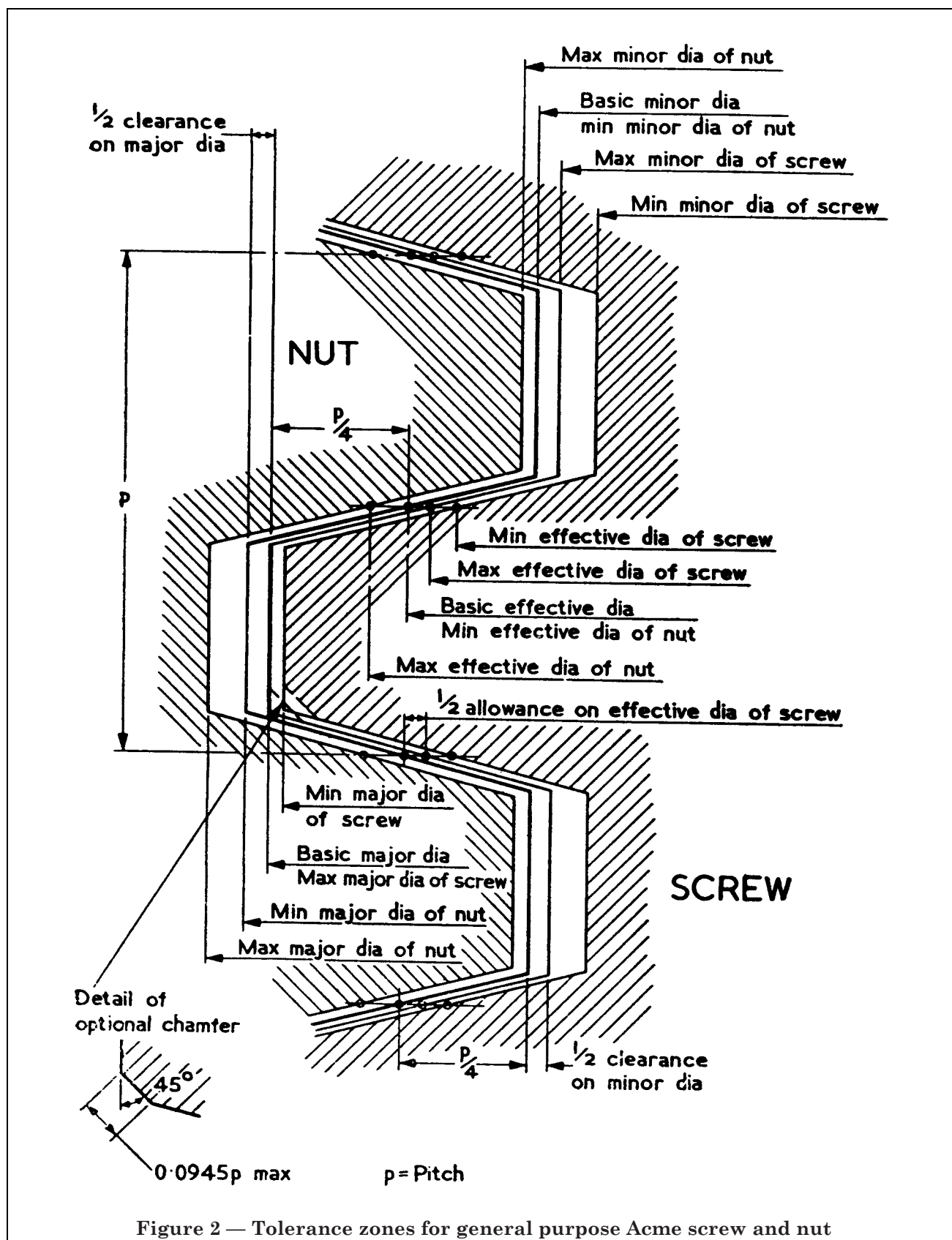


Figure 2 — Tolerance zones for general purpose Acme screw and nut

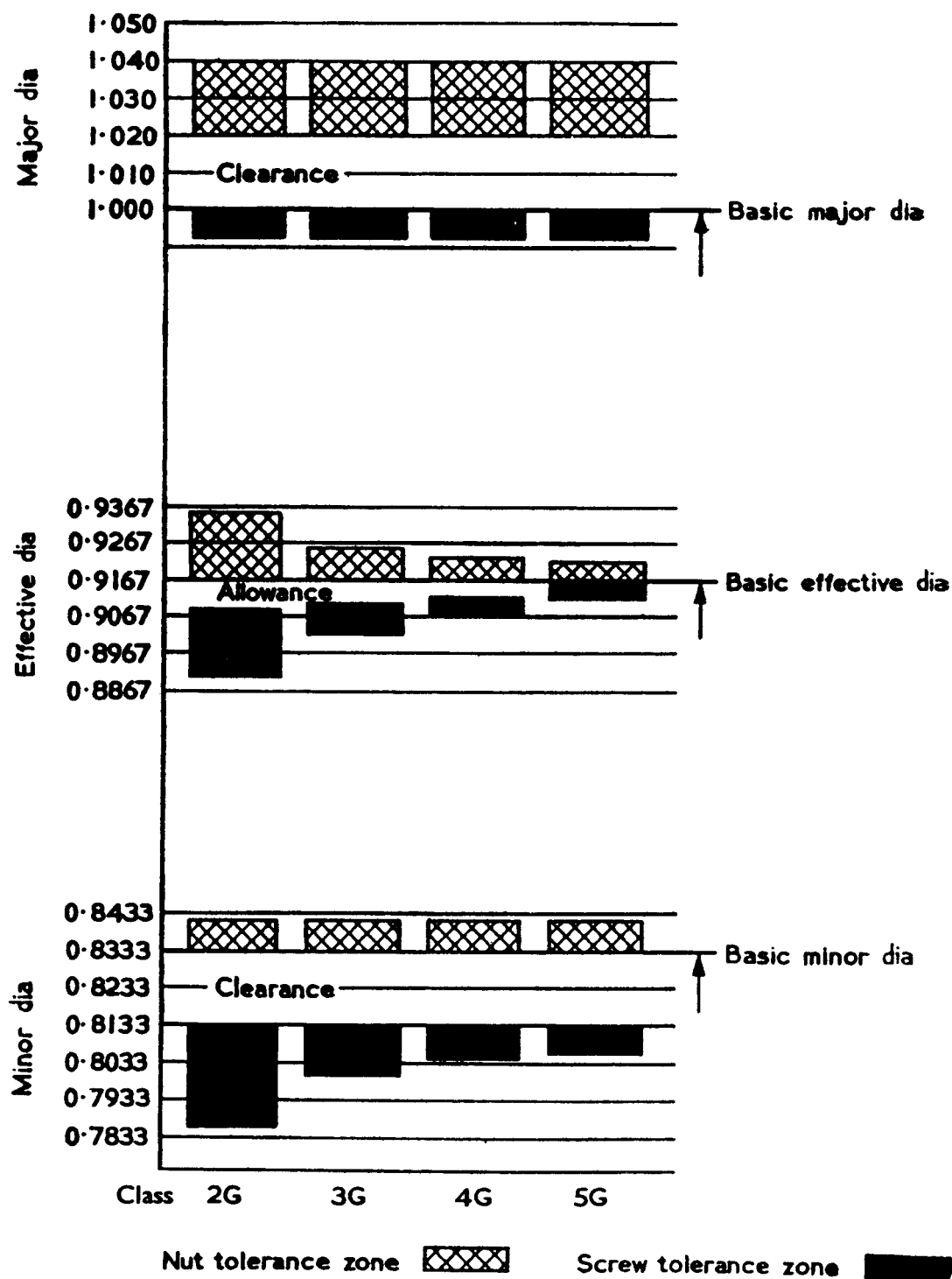


Figure 3 — Diametral tolerances, clearances and allowances for the four classes of general purpose Acme threads of 1 in. dia.—6 T P I

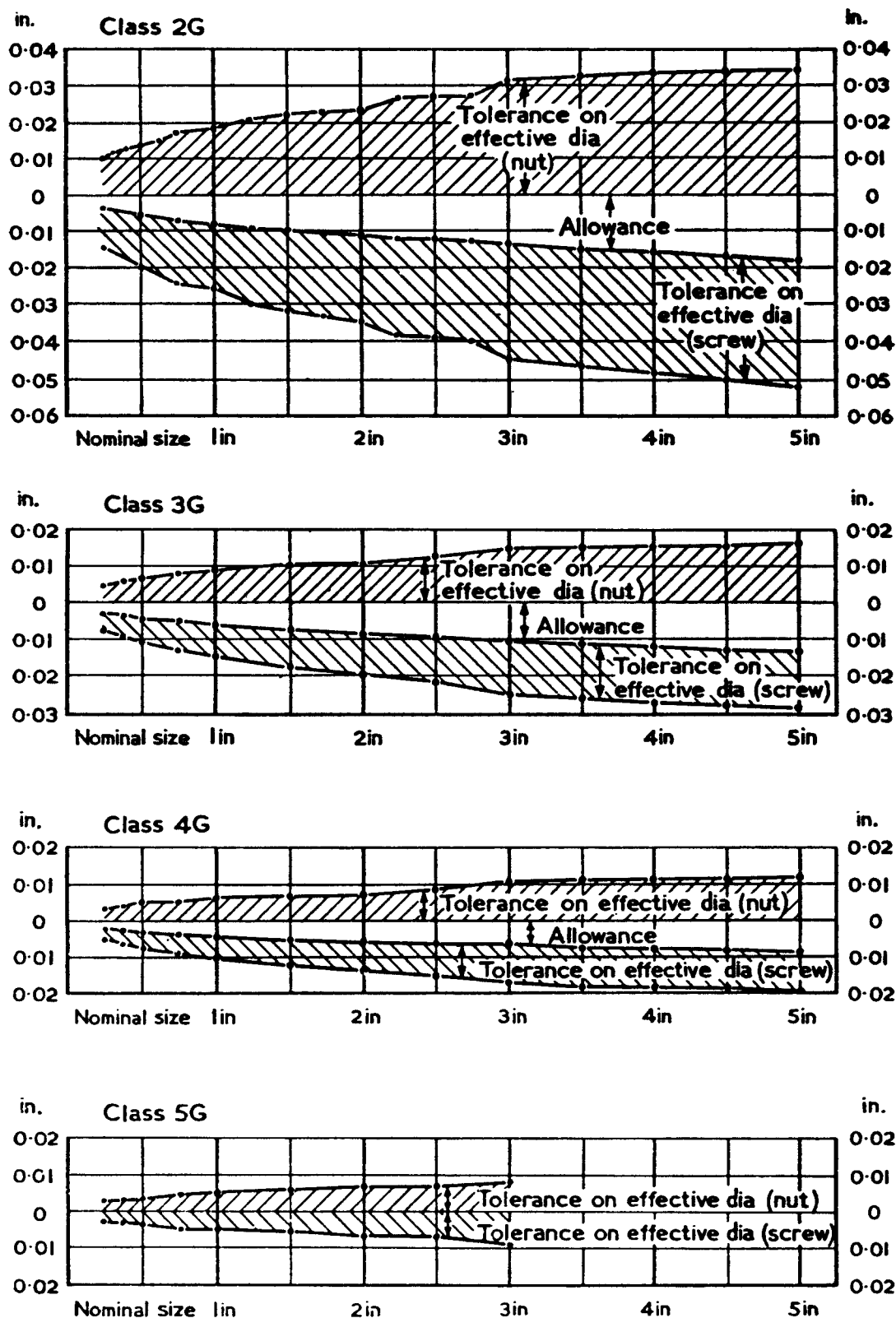


Figure 4 — Effective diameter tolerances and allowances for the standard series