

Australian Standard[®]

**General purpose metric screw
threads**

This Australian standard was prepared by Committee ME/28, Screw Threads. It was approved on behalf of the Council of the Standards Association of Australia on 24 October 1984 and published on 17 May 1985.

The following interests are represented on Committee ME/28:

Confederation of Australian Industry
CSIRO, Division of Applied Physics
Department of Defence
Department of Defence Support
Department of Technical and Further Education, N.S.W.
Electricity Supply Association of Australia
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Australian Standard®

General purpose metric screw
threads

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PREFACE

This edition of this standard was prepared by the Association's Committee on Screw Threads, to supersede AS 1721-1975. AS 1721-1975 was intended to cover the anticipated needs of Australian industry, under the metric system, for general purpose metric screw threads.

Since AS 1721 was first published, the major ISO standards dealing with metric screw threads (see later listing) have been revised, and are now in conflict with the information given in AS 1721-1975. This is particularly true with respect to the graded pitch series of screw threads, the root curvature for external threads, and the limits specified for the thread roots of both external and internal threads.

A further important consideration is that the ISO standards for metric screw threads are now being adopted virtually unchanged by most developed and developing countries, and therefore it is important that the Australian standards be aligned with their ISO counterparts as much as possible. This has been the aim in this edition of AS 1721.

During the preparation of AS 1721 in the early 1970s, it was noted by the committee that the ISO symbols used for the various screw thread parameters were illogical, and so a more logical system was introduced in the Australian standards. This was supported by sustained comment to ISO/TC1 proposing the Australian symbols. Unfortunately the Australian proposals were not accepted by ISO/TC1 and the original ISO symbols were retained. One of the major changes in this edition therefore has been to introduce the ISO symbols for the screw thread parameters.

Another major change has been to include in total the ISO diameter/pitch combinations, for both the graded and constant pitch thread series.

When AS 1721-1975 was being prepared, the ISO standards contained only a fairly comprehensive coarse pitch series, a restricted fine pitch series and a constant pitch series. The latter featured several choices of pitches which could be associated with any given diameter. It was considered that if these had been included in the Australian standard, in that form, at that time, the result almost certainly would have been an over-proliferation of diameter/pitch combinations, to the detriment of Australian industry.

The committee realized that in the early days of metric conversion, industry would need guidance on the selection of suitable diameter/pitch combinations, because there was little experience with respect to metric screw threads. It therefore seemed practical to base the graded pitch screw thread series on previous experience with inch screw threads. With this in mind the following action was taken:

- (a) *To adopt the ISO coarse pitch series*, but extend the size range to 250 mm diameter, by utilizing a constant 6 mm pitch for sizes over 68 mm. The ISO series covers diameters from 1 mm to 68 mm inclusive.
- (b) *To adopt the ISO fine pitch series*, but interpolate additional sizes and extend the size range to 300 mm diameter by utilizing a 3 mm pitch for diameters from 36 mm to 52 mm inclusive, a 4 mm pitch for diameters from 55 mm to 250 mm inclusive, and a 6 mm pitch for diameters from 255 mm to 300 mm inclusive.
- (c) *Not to adopt the ISO constant pitch series.*
- (d) To devise an extra-fine pitch series covering diameters from 8 mm to 300 mm inclusive.
- (e) To devise an extra-coarse pitch series covering diameters from 1.6 mm to 24 mm inclusive.

The above were included in AS 1721-1975, and again were proposed for adoption by ISO. In the 1980 edition of ISO 965, some of the Australian comment was adopted, more specifically that dealing with the fine-pitch thread series, which has now been substantially extended.

At the same time experience in Australia has shown that items (d) and (e) above have received little or no support from Australian industry; item (b) in sizes over about 36 mm also was not used, but there was a growing requirement for the ISO diameter/pitch combinations by various sectors of industry.

It was therefore agreed that this edition of AS 1721 would feature only the ISO diameter/pitch combinations.

The final major change is with regard to the limits given for the thread roots on both external and internal threads. In AS 1721-1975 these limits were completely specified, whereas in the ISO standards only the minimum minor diameter is specified for external threads and the nominal (basic) major diameter is given for internal threads; the actual limits being indirectly controlled by the length of straight flanks.

Furthermore a root curvature for external threads is only specified for threads intended for fasteners of property Class 8.8 and above. All other external threads may have a root configuration in accordance with the basic/design profile.

It was considered that the ISO approach on the limits for the thread roots was practical and should be adopted, because this would permit maximum flexibility in manufacture without being unduly detrimental to either the strength of the screw thread or to its assembly properties. However, the ISO root curvature for external threads taken to the extreme could cause problems by introducing a notch effect, which may lead to fatigue failure in threads in some steels which have a high tensile level and/or have been severely cold worked. A cautionary statement to this effect has therefore been included in this edition.

This standard has been based on and is in complete alignment with the following ISO standards:

ISO 68—1973	ISO General Purpose Screw Threads — Basic Profile
ISO 261—1973	ISO General Purpose Metric Screw Threads — General Plan
ISO 262—1973	ISO General Purpose Metric Screw Threads — Selected Sizes for Screws, Bolts and Nuts
ISO 724—1978	ISO Metric Screw Threads — Basic Dimensions
ISO 965/1—1980	ISO General Purpose Metric Screw Threads — Tolerances Part 1 - Principles and Basic Data
ISO 965/2—1980	ISO General Purpose Metric Screw Threads — Tolerances Part 2 - Limits of Size for General Purpose Bolt and Nut Threads — Medium Quality
ISO 965/3—1980	ISO General Purpose Metric Screw Threads — Tolerances Part 3 — Deviations for Constructional Threads

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STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard

for

GENERAL PURPOSE METRIC SCREW THREADS

SECTION 1. SCOPE AND GENERAL

1.1 SCOPE. This standard specifies requirements for single start parallel metric screw threads having the ISO basic profile for triangular screw threads, covering the size range from 1 mm diameter to 355 mm diameter inclusive.

The metric screw thread system comprises the following series:

- (a) The ISO coarse pitch series, which gives graded diameter/pitch combinations in diameters from 1 mm to 68 mm inclusive, and is predominantly intended for commercially produced threaded fasteners.
- (b) The ISO fine pitch series, which gives graded diameter/pitch combinations in diameters from 1 mm to 33 mm inclusive.
- (c) The ISO constant pitch series, which gives a series of standard pitches to be associated with diameters from 8 mm to 355 mm inclusive.

The standard gives information on screw thread parameters, tolerances, deviations, thread classes, designation and symbols.

Due to the methods adopted by ISO for rounding the tabulated values (see Appendix A), the values for the various parameters given in the tables are to be taken as authoritative for the application of this standard.

Appendices are included giving the basis of the tabulated values, guidelines (with examples) for calculating the limits of size of untabulated screw threads and notes on the production of screw threads.

NOTE: The ISO metric screw thread system, as given in this standard, does not provide for interference fit threads.

1.2 APPLICATION. This standard gives information on the design, manufacture and use of the ISO metric parallel screw thread system.

The standard is intended for adoption by industry and government authorities concerned with the design, manufacture and/or use of metric screw threads.

1.3 REFERENCED DOCUMENTS. The following standards are referred to in this standard:

- AS 1014 Gauging of Metric Screw Threads
- AS 1098 Roller-type Screw Calliper Gauges
- AS 1110 ISO Metric Hexagon Precision Bolts and Screws
- AS 1214 Hot-dip Galvanized Coatings on Threaded Fasteners (ISO Metric Coarse Thread Series)
- AS 1252 High-strength Steel Bolts with Associated Nuts and Washers for Structural Engineering
- AS 1654 Limits and Fits for Engineering
- AS 1897 Electroplated Coatings on Threaded Components (Metric Coarse Series)

AS 2052 Metallic Conduits and Fittings

AS 2053 Non-metallic Conduits and Fittings

AS XXXX Glossary of Terms for Screw Threads*

1.4 DEFINITIONS. For the purpose of this standard, the definitions given in AS XXXX apply.

1.5 SYMBOLS. The symbols used in this standard to define the screw thread parameters are given in Table 1.1.

NOTE: These are now aligned with the ISO symbols. For comparison of the current symbols with those used in AS 1721-1975, see Appendix C.

TABLE 1.1
SYMBOLS

Symbol	Explanation
D	basic major diameter of internal thread
D_1	basic minor diameter of internal thread
D_2	basic pitch diameter of internal thread
d	basic major diameter of external thread
d_1	basic minor diameter of external thread
d_2	basic pitch diameter of external thread
P	pitch
H	height of fundamental triangle
R	root radius of external thread
S	designation for lengths of thread engagement group Short
N	designation for lengths of thread engagement group Normal
L	designation for lengths of thread engagement group Long
T	tolerance
T_{D_1}	tolerance on minor diameter of internal thread
T_{D_2}	tolerance on pitch diameter of internal thread
T_d	tolerance on major diameter of external thread
T_{d_2}	tolerance on pitch diameter of external thread
G, H	fundamental deviations for internal threads
e, f, g, h	fundamental deviations for external threads
A_s	nominal stress area (external threads)

1.6 VERIFICATION. The form and dimensions of screw threads to this standard should preferably be verified by gauging in accordance with AS 1014.

The method(s) of verification (inspection) to be used on any particular occasion will however, depend on such things as the thread diameter, the thread class, the number of items produced, the method of manufacture, etc.

Where gauging is impractical, the threads may be verified by direct measurement or by optical methods; or a combination of both.

* In course of preparation.

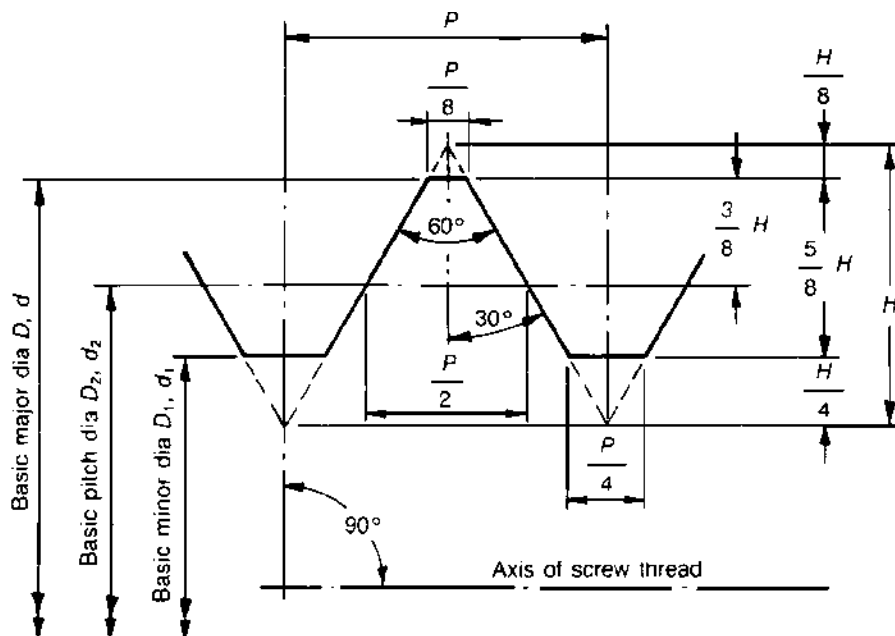
SECTION 2. SCREW THREAD PROFILES

2.1 SCOPE OF SECTION. This Section specifies the basic profile, the maximum material profiles and limiting profiles for external and internal metric screw threads. The Section also includes information on and values of the main elements used to derive the basic screw thread parameters.

2.2 BASIC PROFILE. The basic profile of ISO general purpose metric screw threads is shown in Fig. 2.1. The dimensions for the various pitches are given in Table 2.1.

2.3 MAXIMUM MATERIAL PROFILE.

2.3.1 Maximum material profile — internal thread. The profile of an internal screw thread at its maximum material condition is shown in Fig. 2.2. It is the same as the basic profile except that in practice, the root is rounded as shown by the dotted line, and cleared beyond a width of $P/8$.



$$H = \frac{\sqrt{3}}{2} P = 0.866\,025\,404\,P$$

$$P = \text{pitch}$$

$$H = \text{height of fundamental triangle}$$

NOTE: For explanation of symbols, see Table 1.1.

Fig. 2.1. ISO BASIC PROFILE

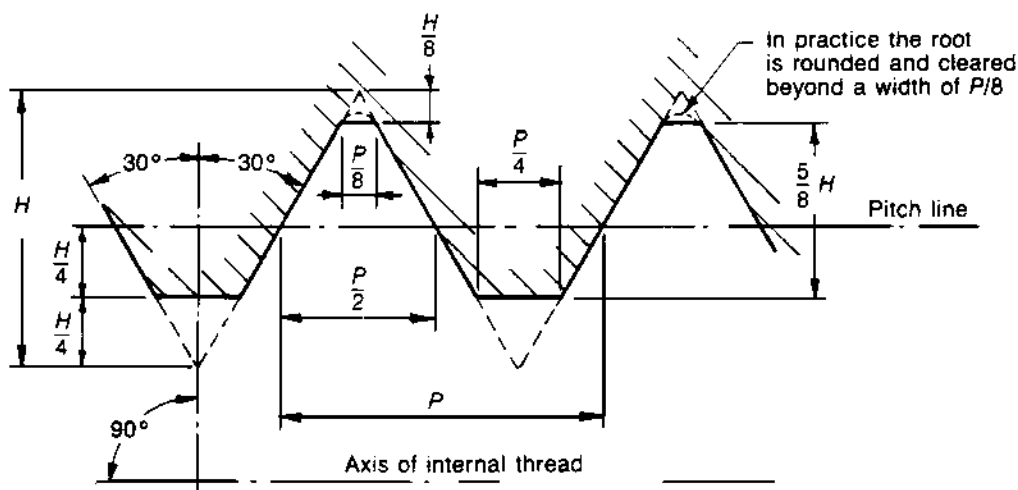


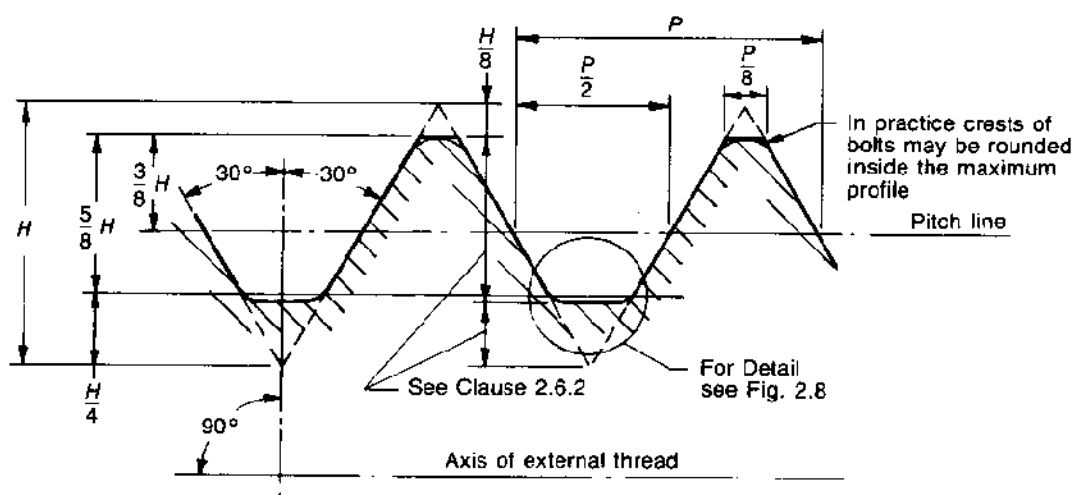
Fig. 2.2. MAXIMUM MATERIAL PROFILE OF AN INTERNAL THREAD

2.3.2 Maximum material profile—external thread. The profile of an external screw thread at its maximum material condition is shown in Fig. 2.3. It is the same as the basic profile, except that —

- in practice the crests may be rounded inside the maximum profile as shown by the dotted line; and
- the thread roots (minor diameter) may require to be modified in accordance with Clause 2.6.2.

TABLE 2.1
DIMENSIONS OF THE BASIC PROFILE

Pitch P	H	$5/8H$	$3/8H$	$H/4$	$H/8$
0.2	0.173 205	0.108 253	0.064 952	0.043 301	0.021 651
0.25	0.216 506	0.135 316	0.081 190	0.054 127	0.027 063
0.3	0.259 808	0.162 380	0.097 428	0.064 952	0.032 476
0.35	0.303 109	0.189 443	0.113 666	0.075 777	0.037 889
0.4	0.346 410	0.216 506	0.129 904	0.086 603	0.043 301
0.45	0.389 711	0.243 570	0.146 142	0.097 428	0.048 714
0.5	0.433 013	0.270 633	0.162 380	0.108 253	0.054 127
0.6	0.519 615	0.324 760	0.194 856	0.129 904	0.064 952
0.7	0.606 218	0.378 886	0.227 332	0.151 554	0.075 777
0.75	0.649 519	0.405 949	0.243 570	0.162 380	0.081 190
0.8	0.692 820	0.433 013	0.259 808	0.173 205	0.086 603
1	0.866 025	0.541 266	0.324 760	0.216 506	0.108 253
1.25	1.082 532	0.676 582	0.405 949	0.270 633	0.135 316
1.5	1.299 038	0.811 899	0.487 139	0.324 760	0.162 380
1.75	1.515 544	0.947 215	0.568 329	0.378 886	0.189 443
2	1.732 051	1.082 532	0.649 519	0.433 013	0.216 506
2.5	2.165 063	1.353 165	0.811 899	0.541 266	0.270 633
3	2.598 076	1.623 798	0.974 279	0.649 519	0.324 760
3.5	3.031 089	1.894 431	1.136 658	0.757 772	0.378 886
4	3.464 102	2.165 063	1.299 038	0.866 025	0.433 013
4.5	3.897 114	2.435 696	1.461 418	0.974 279	0.487 139
5	4.330 127	2.706 329	1.623 798	1.082 532	0.541 266
5.5	4.763 140	2.976 962	1.786 177	1.190 785	0.595 392
6	5.196 152	3.247 595	1.948 557	1.299 038	0.649 519
8	6.928 203	4.330 127	2.598 076	1.732 051	0.866 025



NOTES:

- For details of root curvature, see Clause 2.6.2 and Fig. 2.8.
- The actual form of any rounding of the crests or roots of the thread will not be detected by conventional gauging since such gauges are cleared at the crest and root and only assess the straight flanks over the height of the basic profile, i.e. $5/8H$ radial depth.
- If assessment of the root curvature is required, verification by optical projection is necessary and it is to be stated in the design requirements.

Fig. 2.3. MAXIMUM MATERIAL PROFILE OF AN EXTERNAL THREAD

2.4 LEAST MATERIAL PROFILE. The least material profile of both internal and external threads is derived from the maximum material profile using the information given in Section 4.

2.5 LIMITING PROFILES.

2.5.1 Limiting profiles — internal threads. Typical limiting profiles for internal screw threads, involving

tolerance positions H and G, are shown in Figs 2.4 and 2.5 respectively.

2.5.2 Limiting profiles — external threads. Typical limiting profiles for external screw threads, involving tolerance position h, are shown in Fig. 2.6, and involving tolerance positions e, f and g, are shown in Fig. 2.7.

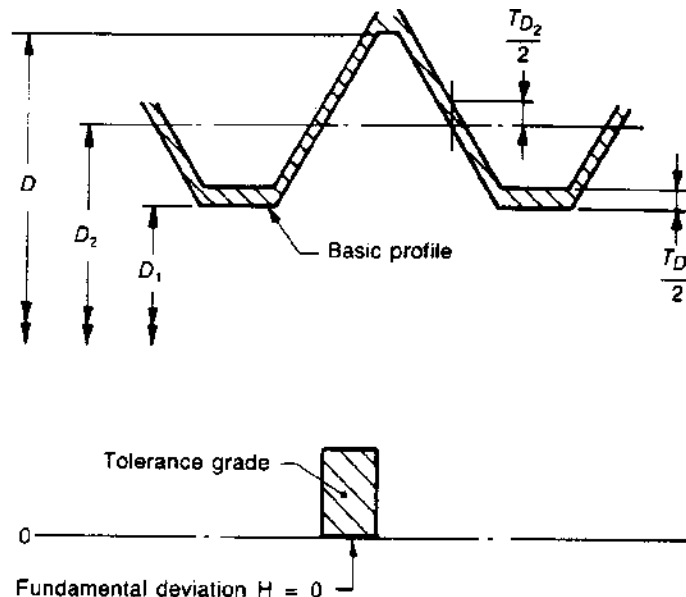


Fig. 2.4. LIMITING PROFILES FOR INTERNAL THREADS—TOLERANCE POSITION H

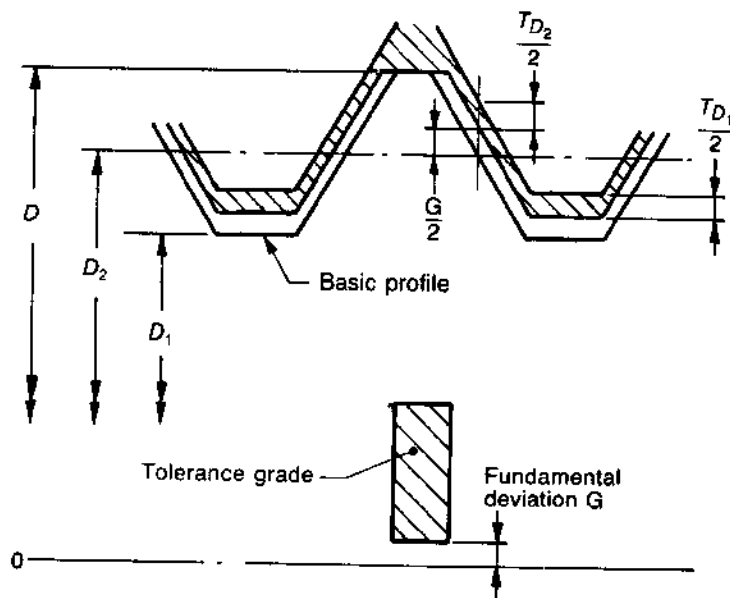


Fig. 2.5. LIMITING PROFILES FOR INTERNAL THREADS—TOLERANCE POSITION G

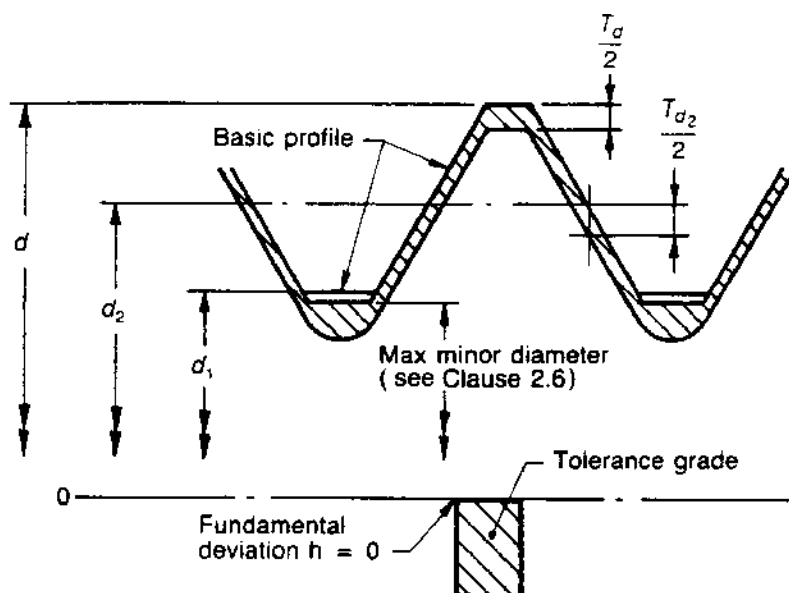


Fig. 2.6. LIMITING PROFILES FOR EXTERNAL THREADS — TOLERANCE POSITION h

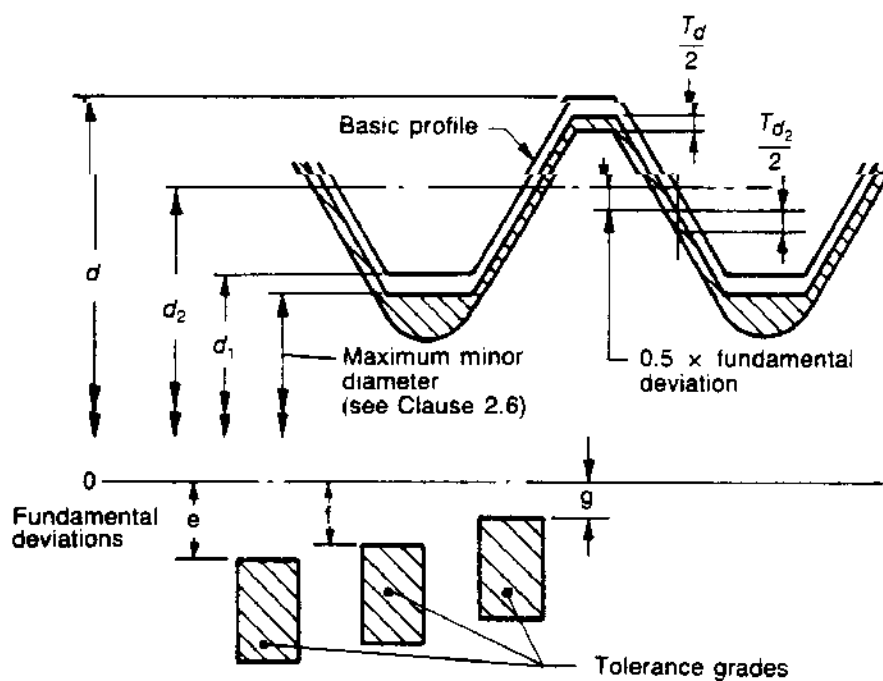


Fig. 2.7. LIMITING PROFILES FOR EXTERNAL THREADS — TOLERANCE POSITIONS e, f, AND g

2.6 ROOT CONTOURS.

2.6.1 Internal threads. The actual root contour shall not at any point transgress the basic profile. In practice the taps used to produce internal threads will normally produce a rounded thread root cleared beyond a width of $P/8$ as shown in Fig. 2.2.

2.6.2 External threads. The actual root contour shall not at any point transgress the basic profile. However it is recommended that the root profile should not be flat, with sharp corners, but should be smoothly rounded.

For threads on fasteners of property Class 8.8 and higher (see AS 1110 and AS 1252) and those on materials with similar properties, the root profile shall have a non-reversing curvature, no portion of which shall have a radius less than $R_{\min}$, which is tangential to the thread flank. The root profile may be comprised of arcs of minimum radius $R_{\min}$, to which the flanks and a flat at the root are tangential (see Fig. 2.8). The values of $R_{\min}$ are given in Table 2.2.

The maximum truncation is—

$$\frac{H}{4} - R_{\min} \left\{ 1 - \cos \left[60^\circ - \arccos \left(1 - \frac{T_{d_2}}{4 \times R_{\min}} \right) \right] \right\} + \frac{T_{d_2}}{2}$$

and the minimum truncation is —

$$0.125P \approx H/7$$

The above principle is recommended for all other external threads, particularly those used in applications subject to fatigue or impact.

External threads must be accepted by a GO screw ring or GO screw calliper gauge.

It is not practical to specify limits for the minor diameter of an external thread. A minimum minor diameter can be derived when the blend radius equals $0.125P$, and the flanks are at the least material condition, but as the flanks approach the maximum material condition the maximum minor diameter will tend to reduce and the limiting values are dependent on the actual crest diameter and pitch diameter of the gauge as well as the subject screw thread (see Fig. 2.8).

As noted in Fig. 2.3, conventional gauging will not examine the root contours and it is recommended that gauging be supplemented by profile projection of the external thread root.

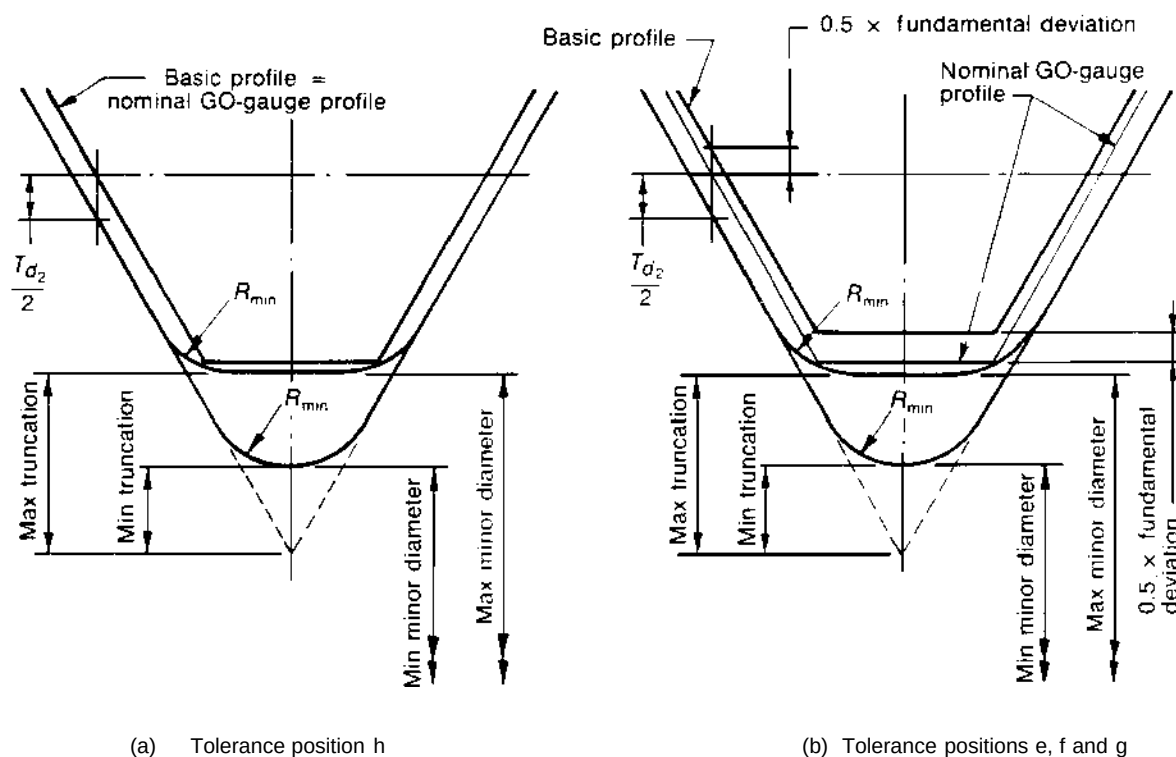


Fig. 2.8. ROOT CONTOURS FOR EXTERNAL THREADS
(See Clause 2.6.2)

TABLE 2.2
MINIMUM ROOT RADII

Pitch <i>P</i>	millimetres
	$R_{\min}$
0.2	0.025
0.25	0.031
0.3	0.038
0.35	0.044
0.4	0.050
0.45	0.056
0.5	0.063
0.6	0.075
0.7	0.088
0.75	0.094
0.8	0.100
1	0.125
1.25	0.156
1.5	0.188
1.75	0.219
2	0.250
2.5	0.313
3	0.375
3.5	0.438
4	0.500
4.5	0.563
5	0.625
5.5	0.688
6	0.750
8	1.000

NOTE: $R_{\min} = 0.125P$.

SECTION 3. GENERAL PLAN

3.1 SCOPE OF SECTION. This Section sets out the general plan, and specifies the basic dimensions for ISO general purpose metric screw threads in diameters from 1 mm to 300 mm inclusive. It covers diameter/pitch combinations for the ISO coarse, fine and constant pitch series together with information on the selection of diameter/pitch combinations not tabled in this standard.

It should be noted that the terms 'coarse series' and 'fine series' relate to the pitch of the thread and no concept of quality should be attached to these terms.

3.2 THREAD SERIES.

3.2.1 General. The ISO metric thread series consists of a graded series of diameters associated with suitable pitches. The pitches selected may vary with diameter or may be constant. Both types of series are included in this standard and are given in Table 3.1.

3.2.2 Coarse pitch series. The coarse pitch series is mainly intended for metric threaded fasteners and other general engineering applications. This series gives good resistance to stripping and is suitable for use with the lower strength and brittle materials such as cast iron, low carbon steels and non-ferrous metals.

3.2.3 Fine pitch series. The fine pitch series is suitable for use where a finer pitch series than the coarse pitch series is required. This series is less resistant to stripping and to repeated tightening than the coarse pitch series. It is not recommended for high duty fasteners over 24 mm diameter, but provided that the length of axial engagement is adequate, it should give sufficient resistance to stripping to develop the full tensile load carrying capacity of the externally threaded member; and subject to the same provisions may be used satisfactorily in the softer materials. The threads of this series have a greater stress area than those of the coarse pitch series.

Particular attention is drawn to the fact that this series has finer pitches than those associated with either the British Standard Whitworth fine series (BSF) or the Unified fine series (UNF). Therefore it should not be assumed that size for size it is always suitable for particular uses for which the BSF or UNF series were previously employed; quite often the coarse pitch series would be more appropriate.

3.2.4 Constant pitch series. The constant pitch series is mainly intended for use in special circumstances, for which the coarse or fine pitch series is unsuitable or inadequate. It is arranged to provide a graded system of diameter/pitch combinations.

3.2.5 Selection of diameter/pitch combinations.

3.2.5.1 Standard series. Having regard to the information given in Clauses 3.2.2, 3.2.3 and 3.2.4, the choice should first be made from the coarse pitch series, then the fine pitch series. If these are not suitable, then select from the constant pitch series using one of the standard pitches for a given diameter wherever possible (see Table 3.1).

The diameter should be selected on the basis of the preferences listed in Table 3.1.

3.2.5.2 Non-standard series. If screw threads finer than those given in Table 3.1 are necessary, only the following pitches shall be used:

3, 2, 1.5, 1, 0.75, 0.5, 0.35, 0.25, 0.2 mm

It should be noted that it becomes increasingly difficult in production to comply with the thread tolerances as the diameter is increased for any given pitch. The recommended maximum diameter to be associated with a particular pitch is given in Table 3.2.

In the diameter range 150 mm to 355 mm, where it is necessary to use a thread with a pitch coarser than 6 mm, the 8 mm pitch should be used.

3.3 BASIC DIMENSIONS. Values for the basic pitch diameter and basic minor diameter for all the diameter/pitch combinations given in Table 3.1 are given in Table 3.3.

These values rounded to the third decimal place have been calculated from the following formulas:

$$D_2 = D - 2 \times 3/8H = D - 0.6495P$$

$$d_2 = d - 2 \times 3/8H = d - 0.6495P$$

$$D_1 = D - 2 \times 5/8H = D - 1.0825P$$

$$d_1 = d - 2 \times 5/8H = d - 1.0825P$$

TABLE 3.1
DIAMETER/PITCH COMBINATIONS

millimetres

Nominal diameters			Pitches							
Col 1	Col 2	Col 3	Coarse pitch series	Fine pitch series	Constant pitch series					
1st choice	2nd choice	3rd choice			3	2	1.5	1.25	1	0.75
1	—	—	0.25	0.2	—	—	—	—	—	—
1.2	1.1 1.4	—	0.25 0.25 0.3	0.2 0.2 0.2	—	—	—	—	—	—
1.6 2	1.8	—	0.35 0.35 0.4	0.2 0.2 0.25	—	—	—	—	—	—
2.5 3	2.2	—	0.45 0.45 0.5	0.25 0.35 0.35	—	—	—	—	—	—
4	3.5 4.5	—	0.6 0.7 0.75	0.35 0.5 0.5	—	—	—	—	—	—
5 6	—	5.5	0.8 1	0.5 (0.5) 0.75	—	—	—	—	—	—
8	—	$\frac{7}{9}$	1 1.25 1.25	0.75 1	—	—	—	—	$\frac{1}{1}$	0.75 0.75
10 12	—	11	1.5 1.5 1.75	1.25 1.25	—	—	1.5	—	$\frac{1}{1}$ $\frac{1}{1}$	0.75 0.75
16	14	15	2 2	1.5 1.5	—	—	1.5	1.25 ⁽²⁾	$\frac{1}{1}$ $\frac{1}{1}$	—
20	18	17	2.5 2.5	1.5 1.5	—	$\frac{2}{2}$	1.5	—	$\frac{1}{1}$ $\frac{1}{1}$	—
24	22	25	2.5 3	1.5 2	—	$\frac{2}{2}$	1.5 1.5	—	$\frac{1}{1}$ $\frac{1}{1}$	—
—	27	26 28	3	2	—	2	1.5 1.5 1.5	—	$\frac{1}{1}$	—
30	33	32 35	3.5 3.5	2 2	(3) (3)	2	1.5 1.5 1.5 1.5 ⁽²⁾	—	1	—
36	39	38	4 4	—	3 3	2 2	1.5 1.5 1.5	—	—	—

1. Pitches shown in brackets are to be avoided as far as possible.
2. The following diameter/pitch combinations are considered standard only for the particular applications indicated:

M14 × 1.25 for spark plugs for engines.

M35 × 1.5 for locking nuts for bearings.

M63 × 1.5 for conduits and fittings in accordance with AS 2052 and AS 2053 only.

TABLE 3.1 (continued)
DIAMETER/PITCH COMBINATIONS

millimetres

Nominal diameters			Pitches					
Col 1	Col 2	Col 3	Coarse pitch series	Constant pitch series				
1st choice	2nd choice	3rd choice		6	4	3	2	1.5
42	45	40	4.5 4.5	—	4 4	3 3 3	2 2 2	1.5 1.5 1.5
48	52	50	5 5	—	4 4	3 3 3	2 2 2	1.5 1.5 1.5
56		55 58	5.5	—	4 4 4	3 3 3	2 2 2	1.5 1.5 1.5
64	60	62 63	5.5 6	—	4 4 4	3 3 3	2 2 2	1.5 1.5 1.5 ⁽²⁾ 1.5
—	68	65 70	6	6	4 4 4	3 3 3	2 2 2	1.5 1.5 1.5
72	76	75	—	6 6	4 4 4	3 3 3	2 2 2	1.5 1.5 1.5
80		78 82	—	6	4	3	2 2 2	1.5
90	85 95	—	—	6 6 6	4 4 4	3 3 3	2 2 2	—
100 110	105	—	—	6 6 6	4 4 4	3 3 3	2 2 2	—
125	115 120	—	—	6 6 6	4 4 4	3 3 3	2 2 2	—
140	130	135	—	6 6 6	4 4 4	3 3 3	2 2 2	—
—	150	145 155	—	6 6 6	4 4 4	3 3 3	2 2	—
160	170	165	—	6 6 6	4 4 4	3 3 3	—	—

TABLE 3.1 (continued)
DIAMETER/PITCH COMBINATIONS

millimetres

Nominal diameters			Pitches					
Col 1	Col 2	Col 3	Coarse pitch series	Constant pitch series				
1st choice	2nd choice	3rd choice		6	4	3	2	1.5
180	—	175 185	—	6 6 6	4 4 4	3 3 3	—	—
200	190	195	—	6 6 6	4 4 4	3 3 3	—	—
—	210	205 215	—	6 6 6	4 4 4	3 3 3	—	—
220	—	225 230	—	6 6 6	4 4 4	3 3 3	—	—
—	240	235 245	—	6 6 6	4 4 4	3 3 3	—	—
250	260	255	—	6 6 6	4 4 4	3	—	—
—	—	265 270 275	—	6 6 6	4 4 4	—	—	—
280	—	285 290	—	6 6 6	4 4 4	—	—	—
—	300	295		6 6	4 4			

TABLE 3.2
**RECOMMENDED MAXIMUM DIAMETERS
AND ASSOCIATED PITCHES**

millimetres

Pitch	Maximum diameter
0.5	22
0.75	33
1	80
1.5	150
2	200
3	300

TABLE 3.3
BASIC DIMENSIONS

millimetres			
Basic major diameter <i>D, d</i>	Pitch <i>P</i>	Pitch diameter	Minor diameter
1	0.25 0.2	0.838 0.870	0.729 0.783
1.1	0.25 0.2	0.938 0.970	0.829 0.883
1.2	0.25 0.2	1.038 1.070	0.929 0.983
1.4	0.3 0.2	1.205 1.270	1.075 1.183
1.6	0.35 0.2	1.373 1.470	1.221 1.383
1.8	0.35 0.2	1.573 1.670	1.421 1.583
2	0.4 0.25	1.740 1.838	1.567 1.729
2.2	0.45 0.25	1.908 2.038	1.713 1.929
2.5	0.45 0.35	2.208 2.273	2.013 2.121
3	0.5 0.35	2.675 2.773	2.459 2.621
3.5	0.6 0.35	3.110 3.273	2.850 2.121
4	0.7 0.5	3.545 3.675	3.242 3.459
4.5	0.75 0.5	4.013 4.175	3.688 3.959
5	0.8 0.5	4.480 4.675	4.134 4.459
5.5	0.5	5.175	4.959
6	1 0.75	5.350 5.513	4.917 5.188
7	1 0.75	6.350 6.513	5.917 6.188
8	1.25 1 0.75	7.188 7.350 7.513	6.647 6.917 7.188
9	1.25 1 0.75	8.188 8.350 8.513	7.647 7.917 8.188
10	1.5 1.25 1 0.75	9.026 9.188 9.350 9.513	8.376 8.647 8.917 9.188
11	1.5 1 0.75	10.026 10.350 10.513	9.376 9.917 10.188
12	1.75 1.5 1.25 1	10.863 11.026 11.188 11.350	10.106 10.376 10.647 10.917
14	2 1.5 1.25 1	12.701 13.026 13.188 13.350	11.835 12.376 12.647 12.917

millimetres			
Basic major diameter <i>D, d</i>	Pitch <i>P</i>	Pitch diameter	Minor diameter
15	1.5 1	14.026 14.350	13.376 13.917
16	2 1.5 1	14.701 15.026 15.350	13.835 14.376 14.917
17	1.5 1	16.026 16.350	15.376 15.917
18	2.5 2 1.5 1	16.376 16.701 17.026 17.350	15.294 15.835 16.376 16.917
20	2.5 2 1.5 1	18.376 18.701 19.026 19.350	17.294 17.835 18.376 18.917
22	2.5 2 1.5 1	20.376 20.701 21.026 21.350	19.294 19.835 20.376 20.917
24	3 2 1.5 1	22.051 22.701 23.026 23.350	20.752 21.835 22.376 22.917
25	2 1.5 1	23.701 24.026 24.350	22.835 23.376 23.917
26	1.5	25.026	24.376
27	3 2 1.5 1	25.051 25.701 26.026 26.350	23.752 24.835 25.376 25.917
28	2 1.5 1	26.701 27.026 27.350	25.835 26.376 26.917
30	3.5 3 2 1.5 1	27.727 28.051 28.701 29.026 29.350	26.211 26.752 27.835 28.376 28.917
32	2 1.5	30.701 31.026	29.835 30.376
33	3.5 3 2 1.5	30.727 31.051 31.701 32.026	29.211 29.752 30.835 31.376
35	1.5	34.026	33.376
36	4 3 2 1.5	33.402 34.051 34.701 35.026	31.670 32.752 33.835 34.376
38	1.5	37.026	36.376
39	4 3 2 1.5	36.402 37.051 37.701 38.026	34.670 35.752 36.835 37.376
40	3 2 1.5	38.051 38.701 39.026	36.752 37.835 38.376

TABLE 3.3 (continued)
BASIC DIMENSIONS

millimetres			
Basic major diameter <i>D, d</i>	Pitch <i>P</i>	Pitch diameter	Minor diameter
42	4.5	39.077	37.129
	4	39.402	37.670
	3	40.051	38.752
	2	40.701	39.835
	1.5	41.026	40.376
45	4.5	42.077	40.129
	4	42.402	40.670
	3	43.051	41.752
	2	43.701	42.835
	1.5	44.026	43.376
48	5	44.752	42.587
	4	45.402	43.670
	3	46.051	44.752
	2	46.701	45.835
	1.5	47.026	46.376
50	3	48.051	46.752
	2	48.701	47.835
	1.5	49.026	48.376
52	5	48.752	46.587
	4	49.402	47.670
	3	50.051	48.752
	2	50.701	49.835
	1.5	51.026	50.376
55	4	52.402	50.670
	3	53.051	51.752
	2	53.701	52.835
	1.5	54.026	53.376
56	5.5	52.428	50.046
	4	53.402	51.670
	3	54.051	52.752
	2	54.701	53.835
	1.5	55.026	54.376
58	4	55.402	53.670
	3	56.051	54.752
	2	56.701	55.835
	1.5	57.026	56.376
60	5.5	56.428	54.046
	4	57.402	55.670
	3	58.051	56.752
	2	58.701	57.835
	1.5	59.026	58.376
62	4	59.402	57.670
	3	60.051	58.752
	2	60.701	59.835
	1.5	61.026	60.376
63	1.5	62.026	61.376
64	6	60.103	57.505
	4	61.402	59.670
	3	62.051	60.752
	2	62.701	61.835
	1.5	63.026	62.376
65	4	62.402	60.670
	3	63.051	61.752
	2	63.701	62.835
	1.5	64.026	63.376
68	6	64.103	61.505
	4	65.402	63.670
	3	66.051	64.752
	2	66.701	65.835
	1.5	67.026	66.376

millimetres			
Basic major diameter <i>D, d</i>	Pitch <i>P</i>	Pitch diameter	Minor diameter
70	6	66.103	63.505
	4	67.402	65.670
	3	68.051	66.752
	2	68.701	67.835
	1.5	69.026	68.376
72	6	68.103	65.505
	4	69.402	67.670
	3	70.051	68.752
	2	70.701	69.835
	1.5	71.026	70.376
75	4	72.402	70.670
	3	73.051	71.752
	2	73.701	72.835
	1.5	74.026	73.376
76	6	72.103	69.505
	4	73.402	71.670
	3	74.051	72.752
	2	74.701	73.835
	1.5	75.026	74.376
78	2	76.701	75.835
80	6	76.103	73.505
	4	77.402	75.670
	3	78.051	76.752
	2	78.701	77.835
82	1.5	79.026	78.376
	2	80.701	79.835
85	6	81.103	78.505
	4	82.402	80.670
	3	83.051	81.752
	2	83.701	82.835
90	6	86.103	83.505
	4	87.402	85.670
	3	88.051	86.752
	2	88.701	87.835
95	6	91.103	88.505
	4	92.402	90.670
	3	93.051	91.752
	2	93.701	92.835
100	6	96.103	93.505
	4	97.402	95.670
	3	98.051	96.752
	2	98.701	97.835
105	6	101.103	98.505
	4	102.402	100.670
	3	103.051	101.752
	2	103.701	102.835
110	6	106.103	103.505
	4	107.402	105.670
	3	108.051	106.752
	2	108.701	107.835
115	6	111.103	108.505
	4	112.402	110.670
	3	113.051	111.752
	2	113.701	112.835
120	6	116.103	113.505
	4	117.402	115.670
	3	118.051	116.752
	2	118.701	117.835

TABLE 3.3 (continued)
BASIC DIMENSIONS

millimetres			
Basic major diameter <i>D, d</i>	Pitch <i>P</i>	Pitch diameter	Minor diameter
125	6	121.103	118.505
	4	122.402	120.670
	3	123.051	121.752
	2	123.701	122.835
130	6	126.103	123.505
	4	127.402	125.670
	3	128.051	126.752
	2	128.701	127.835
135	6	131.103	128.505
	4	132.402	130.670
	3	133.051	131.752
	2	133.701	132.835
140	6	136.103	133.505
	4	137.402	135.670
	3	138.051	136.752
	2	138.701	137.835
145	6	141.103	138.505
	4	142.402	140.670
	3	143.051	141.752
	2	143.701	142.835
150	6	146.103	143.505
	4	147.402	145.670
	3	148.051	146.752
	2	148.701	147.835
155	6	151.103	148.505
	4	152.402	150.670
	3	153.051	151.752
160	6	156.103	153.505
	4	157.402	155.670
	3	158.051	156.752
165	6	161.103	158.505
	4	162.402	160.670
	3	163.051	161.752
170	6	166.103	163.505
	4	167.402	165.670
	3	168.051	166.752
175	6	171.103	168.505
	4	172.402	170.670
	3	173.051	171.752
180	6	176.103	173.505
	4	177.402	175.670
	3	178.051	176.752
185	6	181.103	178.505
	4	182.402	180.670
	3	183.051	181.752
190	6	186.103	183.505
	4	187.402	185.670
	3	188.051	186.752
195	6	191.103	188.505
	4	192.402	190.670
	3	193.051	191.752
200	6	196.103	193.505
	4	197.402	195.670
	3	198.051	196.752
205	6	201.103	198.505
	4	202.402	200.670
	3	203.051	201.752

millimetres			
Basic major diameter <i>D, d</i>	Pitch <i>P</i>	Pitch diameter	Minor diameter
210	6	206.103	203.505
	4	207.402	205.670
	3	208.051	206.752
215	6	211.103	208.505
	4	212.402	210.670
	3	213.051	211.752
220	6	216.103	213.505
	4	217.402	215.670
	3	218.051	216.752
225	6	221.103	218.505
	4	222.402	220.670
	3	223.051	221.752
230	6	226.103	223.505
	4	227.402	225.670
	3	228.051	226.752
235	6	231.103	228.505
	4	232.402	230.670
	3	233.051	231.752
240	6	236.103	233.505
	4	237.402	235.670
	3	238.051	236.752
245	6	241.103	238.505
	4	242.402	240.670
	3	243.051	241.752
250	6	246.103	243.505
	4	247.402	245.670
	3	248.051	246.752
255	6	251.103	248.505
	4	252.402	250.670
260	6	256.103	253.505
	4	257.402	255.670
265	6	261.103	258.505
	4	262.402	260.670
270	6	266.103	263.505
	4	267.402	265.670
275	6	271.103	268.505
	4	272.402	270.670
280	6	276.103	273.505
	4	277.402	275.670
285	6	281.103	278.505
	4	282.402	280.670
290	6	286.103	283.505
	4	287.402	285.670
295	6	291.103	288.505
	4	292.402	290.670
300	6	296.103	293.505
	4	297.402	295.670

NOTE: No basic dimensions given for diameters
> 300 ≤ 350 mm.

SECTION 4. TOLERANCES, DEVIATIONS AND TOLERANCE CLASSES

4.1 SCOPE OF SECTION. This Section sets out the ISO thread tolerance system and gives information on the tolerance grades, fundamental deviations and tolerance classes used for metric threads.

The Section also gives information on the lengths of thread engagement, together with recommended tolerance qualities for external and internal threads and their suggested application. Also included are tabulated values of the upper and lower deviations for the pitch diameter and minor diameter of internal threads, and the pitch diameter and major diameter of external threads, for all the tolerance classes covered by the thread tolerance system.

Formulas for the derivation of the tolerance grades and fundamental deviations are given in Appendix A.

It should be noted that because of the rounding rules used for the tabulated values, such values should be taken as authoritative in the application of the thread system. (For further information, see Appendix A.)

4.2 TOLERANCE POSITIONS. The following tolerance positions are given in this standard:

- (a) For internal threads:
 - G with a positive fundamental deviation.
 - H with zero fundamental deviation.
 See Figs 2.4 and 2.5.
- (b) For external threads:
 - e, f and g with a negative fundamental deviation.
 - h with zero fundamental deviation.

Values of the fundamental deviations are given in Table 4.1

NOTE: Tolerance position e is limited to pitches 0.5 mm and coarser, and tolerance position f to pitches 0.35 mm and coarser.

4.3 FUNDAMENTAL DEVIATIONS.

4.3.1 General. This standard only covers screw threads which are intended to assemble without interference. The minimum clearance between mating threads is assured by applying the fundamental deviation to both the internal and external threads. The fundamental deviations are designated by upper case letters for internal threads and lower case letters for external threads, and positioned with respect to basic size as shown in Fig. 4.1.

4.3.2 Internal threads. The system provides two fundamental deviations for internal threads designated G

and H. Values for the fundamental deviations are given in Table 4.1. The deviations are applicable to the pitch diameter and minor diameter, and should be algebraically added to the basic pitch diameter or basic minor diameter as relevant.

4.3.3 External threads. The system provides four fundamental deviations for external threads designated e, f, g and h. Values for the fundamental deviations are given in Table 4.1. The deviations are applicable to the pitch diameter and major diameter, and should be algebraically added to the basic pitch diameter or basic major diameter as relevant.

4.4 TOLERANCE GRADES.

4.4.1 General. The ISO tolerance system for metric threads provides the following tolerance grades:

- (a) *Internal threads.*

Parameter	Tolerance grade
Pitch diameter	4, 5, 6, 7, 8
Minor diameter	4, 5, 6, 7, 8
- (b) *External threads.*

Parameter	Tolerance grade
Major diameter	4, 6, 8
Pitch diameter	3, 4, 5, 6, 7, 8, 9

NOTES:

1. For information on the tolerances for the internal thread major diameter and external thread minor diameter, see Clauses 4.4.4.1 and 4.4.4.2.
2. The formulas for deriving the values of the tolerance grades are given in Appendix A.
3. The tolerance is algebraically added to the fundamental deviation to form a tolerance class. For further information on tolerance classes for internal and external threads, see Clause 4.5.

4.4.2 Pitch diameter tolerances. The pitch diameter tolerances for all standard pitches of internal threads, tolerance grades 4, 5, 6, 7 and 8, for diameters from 1 mm to 355 mm inclusive, are given in Table 4.2.

The pitch diameter tolerances for all standard pitches of external threads, tolerance grades 3, 4, 5, 6, 7, 8 and 9, for diameters from 1 mm to 355 mm inclusive, are given in Table 4.3.

For data on the calculation of tolerance grades for both internal and external threads, see Appendices A and B.

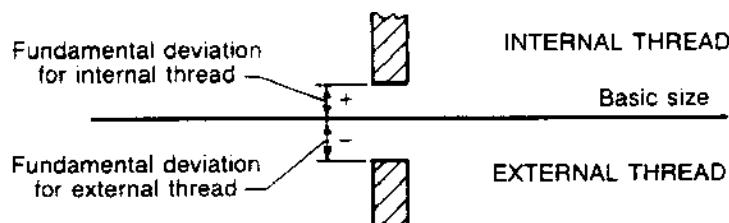


Fig. 4.1. SCREW THREAD DEVIATIONS

4.4.3 Crest diameter tolerances.

4.4.3.1 Internal threads. The minor diameter tolerances for all standard pitches, tolerance grades 4, 5, 6, 7 and 8, are given in Table 4.4.

4.4.3.2 External threads. The major diameter tolerances for all standard pitches, tolerance grades 4, 6 and 8, are given in Table 4.5.

4.4.4 Root diameter tolerances.

4.4.4.1 Internal threads. As indicated in Clause 2.6.1, no specific tolerances are given for the major diameter of internal threads. This parameter is considered acceptable, provided that no portion of the root curvature transgresses the basic profile. For convenience the minimum major diameter, which equals the basic major diameter, is given in the tabulated values of screw thread limits (see Table 5.1).

4.4.4.2 External threads. As indicated in Clause 2.6.2, no specific tolerances are given for the minor diameter of external threads. This parameter is considered acceptable, provided that the root curvature is in agreement with Clause 2.6.2 and the minimum minor diameter is not less than that specified for the appropriate tolerance class in Table 5.1 (for further information see Appendix A, Paragraph A6.1).

4.5 TOLERANCE CLASSES.

4.5.1 General. The method of defining a tolerance class for ISO metric screw threads comprises two elements, and consists of a number describing the selected tolerance grade, followed by an upper or lower case letter describing the selected fundamental deviation —

e.g.

External threads : 6g 6h

Internal threads : 6H 6G

NOTES:

1. For external threads it may sometimes be necessary to apply a different tolerance class to the pitch diameter than that chosen for the major diameter. In this case the pitch diameter tolerance class shall precede the major diameter tolerance class in the designation, e.g. 5g/6g (see Section 6).
2. The tolerance class system for metric screw threads as given in this standard is in no way related to the general system for limits and fits as given in AS 1654.

4.5.2 Disposition of tolerance classes. The tolerance classes are disposed about the basic pitch and major diameter for external threads and the basic pitch and minor diameter for internal threads as shown in Fig. 4.2.

Fig. 4.2 illustrates the disposition of the various tolerance classes relative to the basic pitch diameter but the same principles apply to the other basic diameters previously noted.

4.5.3 Selection of tolerance classes.

4.5.3.1 General. The tolerance classes for the pitch and crest diameters shall be selected in accordance with Clauses 4.5.3.2 to 4.5.3.4, bearing in mind the intended application of the screw threads.

4.5.3.2 Length of axial thread engagement. The length of thread engagement is classified into three groups, short, normal or long in accordance with Table 4.6. If the actual length of thread engagement is unknown (as in the manufacturing of standard bolts), the normal length of engagement is recommended.

4.5.3.3 Preferred tolerance classes. The tolerance classes shall be selected from those given in Tables 4.7 and 4.8 in order to minimize the number of tools and gauges required to produce and inspect the screw threads.

To further assist in the correct selection of tolerance classes, the tolerance classes have been grouped into tolerance qualities as shown in Tables 4.7 and 4.8.

The tolerance quality 'Fine' is intended for precision threads where little variation of the character of fit between external and internal threads is required.

The tolerance quality 'Medium' is intended for general applications.

The tolerance quality 'Coarse' is intended for cases where manufacturing difficulties may arise, for example threading hot rolled bars or tapping long blind holes.

The tolerance classes shown in Tables 4.7 and 4.8 should be selected as follows:

Tolerance classes within frames — standard bolt and nut threads.

Tolerance classes marked thus * — first choice.

Tolerance classes marked thus ** — second choice.

Tolerance classes marked thus *** — third choice.

NOTES:

1. Third choice tolerance classes should be avoided wherever possible.
2. Any of the recommended tolerance classes for internal threads may be combined with any of the recommended tolerance classes for external threads, except thread sizes 1.4 mm and smaller, where the combination 5H/6h or tighter is to be used. For sizes greater than 1.4 mm, in order to provide sufficient radial engagement, the finished components should preferably form the fits H/g, H/h or G/h.

4.5.3.4 Recommended assembly combinations. Although there is no direction or guidance given by ISO for the combination of thread classes between an external and an internal thread, the general practice is to select similar tolerance classes for mating components. The following combinations are recommended.

- (a) Commercial quality fasteners — 6H nut with 8g bolt.
- (b) Precision quality fasteners — 6H nut with 6g bolt.
- (c) Close fit connections — 5H internal with 4h external.
- (d) Medium fit connections — 6H internal with 6g external.
- (e) Free fit connections — 6G internal with 6e external.

4.6 DEVIATIONS FOR SCREW THREADS. The upper and lower deviations for the tolerance classes given in Tables 4.7 and 4.8 for diameters from 1 mm to 300 mm inclusive and pitches from 0.2 mm to 6 mm inclusive are given in Table 4.9. These deviations should be algebraically added to the basic major, pitch or minor diameter as relevant.

4.7 COATED THREADS. The tolerances and deviations given in Clause 4.4 apply to the screw threads before coating, unless otherwise stated. After coating the maximum material limits of coated screw threads, except hot-dip galvanized threads*, shall not at any point exceed the maximum material limits given for tolerance position H or h, i.e. the basic size.

NOTE: Fundamental deviations e and f are principally intended for preplate screw thread dimensions. For further information, see AS 1897.

* For hot dip galvanized threads, see AS 1214.

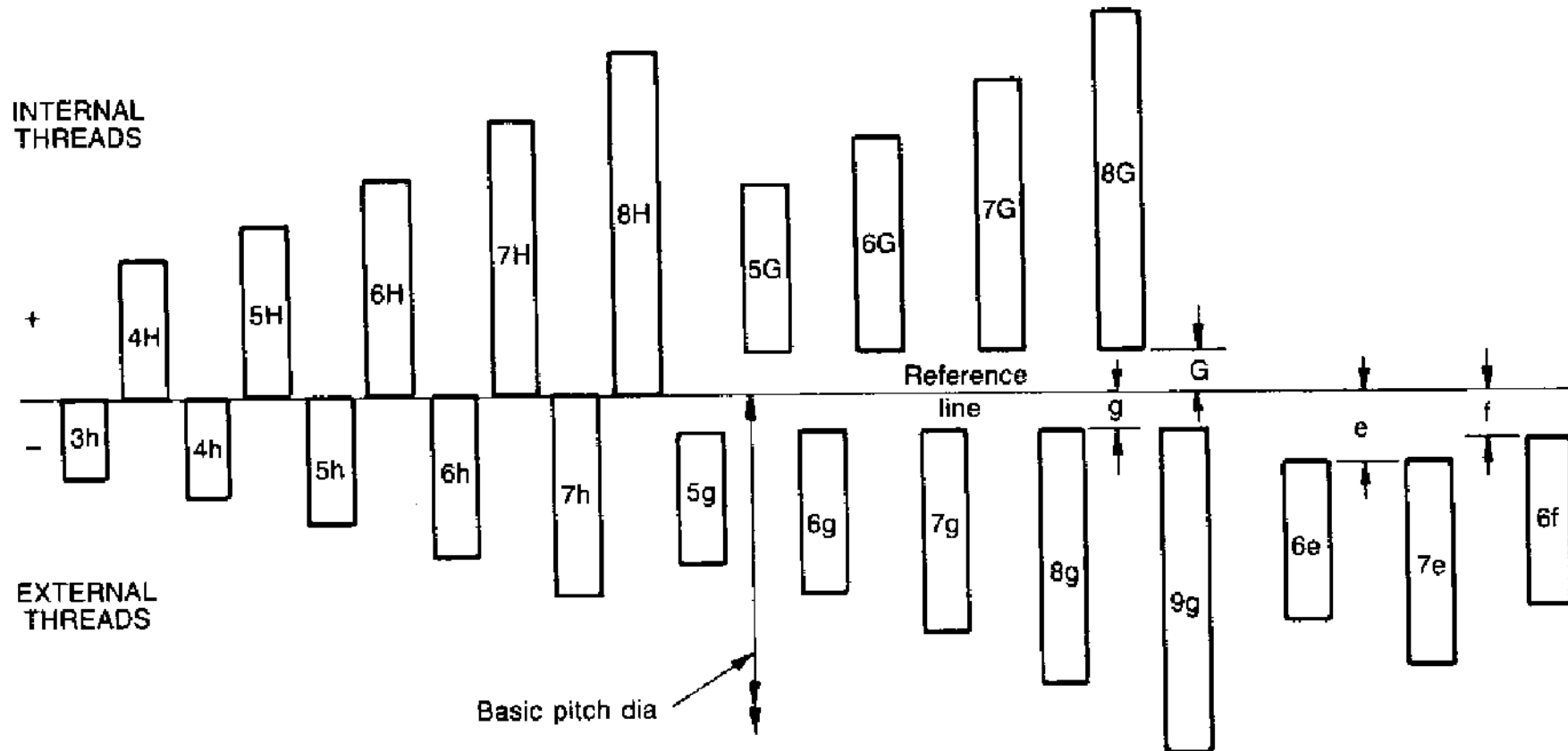


Fig. 4.2. RELATIVE POSITION OF TOLERANCE CLASSES

TABLE 4.1
FUNDAMENTAL DEVIATIONS

Pitch <i>P</i> mm	Fundamental deviation, μm					
	Internal threads		External threads			
	G	H	e	f	g	h
0.2	+17	0			-17	0
0.25	+18	0			-18	0
0.3	+18	0			-18	0
0.35	+19	0		-34	-19	0
0.4	+19	0		-34	-19	0
0.45	+20	0		-35	-20	0
0.5	+20	0	-50	-36	-20	0
0.6	+21	0	-53	-36	-21	0
0.7	+22	0	-56	-38	-22	0
0.75	+22	0	-56	-38	-22	0
0.8	+24	0	-60	-38	-24	0
1	+26	0	-60	-40	-26	0
1.25	+28	0	-63	-42	-28	0
1.5	+32	0	-67	-45	-32	0
1.75	+34	0	-71	-48	-34	0
2	+38	0	-71	-52	-38	0
2.5	+42	0	-80	-58	-42	0
3	+48	0	-85	-63	-48	0
3.5	+53	0	-90	-70	-53	0
4	+60	0	-95	-75	-60	0
4.5	+63	0	-100	-80	-63	0
5	+71	0	-106	-85	-71	0
5.5	+75	0	-112	-90	-75	0
6	+80	0	-118	-95	-80	0

TABLE 4.2
PITCH DIAMETER TOLERANCES FOR INTERNAL THREADS

Basic major diameter		Pitch <i>P</i> mm	Tolerance, μm				
<i>D</i> mm			Tolerance grade				
Over	Up to and including		4	5	6	7	8
0.99	1.4	0.2	40	—	—	—	—
		0.25	45	56	—	—	—
		0.3	48	60	75	—	—
1.4	2.8	0.2	42	—	—	—	—
		0.25	48	60	—	—	—
		0.35	53	67	85	—	—
		0.4	56	71	90	—	—
		0.45	60	75	95	—	—
2.8	5.6	0.35	56	71	90	—	—
		0.5	63	80	100	125	—
		0.6	71	90	112	140	—
		0.7	75	95	118	150	—
		0.75	75	95	118	150	—
		0.8	80	100	125	160	200
5.6	11.2	0.75	85	106	132	170	—
		1	95	118	150	190	236
		1.25	100	125	160	200	250
		1.5	112	140	180	224	280
11.2	22.4	1	100	125	160	200	250
		1.25	112	140	180	224	280
		1.5	118	150	190	236	300
		1.75	125	160	200	250	315
		2	132	170	212	265	335
		2.5	140	180	224	280	355
22.4	45	1	106	132	170	212	—
		1.5	125	160	200	250	315
		2	140	180	224	280	355
		3	170	212	265	335	425
		3.5	180	224	280	355	450
		4	190	236	300	375	475
		4.5	200	250	315	400	500
45	90	1.5	132	170	212	265	335
		2	150	190	236	300	375
		3	180	224	280	355	450
		4	200	250	315	400	500
		5	212	265	335	425	530
		5.5	224	280	355	450	560
		6	236	300	375	475	600
90	180	2	160	200	250	315	400
		3	190	236	300	375	475
		4	212	265	335	425	530
		6	250	315	400	500	630
180	355	3	212	265	335	425	530
		4	236	300	375	475	600
		6	265	335	425	530	670

TABLE 4.3

PITCH DIAMETER TOLERANCES FOR EXTERNAL THREADS

Basic major diameter d mm		Pitch P mm	Tolerance, μm						
Over	Up to and including		Tolerance grade						
			3	4	5	6	7	8	9
0.99	1.4	0.2	24	30	38	48	—	—	—
		0.25	26	34	42	53	—	—	—
		0.3	28	36	45	56	—	—	—
1.4	2.8	0.2	25	32	40	50	—	—	—
		0.25	28	36	45	56	—	—	—
		0.35	32	40	50	63	80	—	—
		0.4	34	42	53	67	85	—	—
		0.45	36	45	56	71	90	—	—
2.8	5.6	0.35	34	42	53	67	85	—	—
		0.5	38	48	60	75	95	—	—
		0.6	42	53	67	85	106	—	—
		0.7	45	56	71	90	112	—	—
		0.75	45	56	71	90	112	—	—
		0.8	48	60	75	95	118	150	190
5.6	11.2	0.75	50	63	80	100	125	—	—
		1	56	71	90	112	140	180	224
		1.25	60	75	95	118	150	190	236
		1.5	67	85	106	132	170	212	265
11.2	22.4	1	60	75	95	118	150	190	236
		1.25	67	85	106	132	170	212	265
		1.5	71	90	112	140	180	224	280
		1.75	75	95	118	150	190	236	300
		2	80	100	125	160	200	250	315
		2.5	85	106	132	170	212	265	335
22.4	45	1	63	80	100	125	160	200	250
		1.5	75	95	118	150	190	236	300
		2	85	106	132	170	212	265	335
		3	100	125	160	200	250	315	400
		3.5	106	132	170	212	265	335	425
		4	112	140	180	224	280	355	450
		4.5	118	150	190	236	300	375	475
45	90	1.5	80	100	125	160	200	250	315
		2	90	112	140	180	224	280	355
		3	106	132	170	212	265	335	425
		4	118	150	190	236	300	375	475
		5	125	160	200	250	315	400	500
		5.5	132	170	212	265	335	425	530
		6	140	180	224	280	355	450	560
90	180	2	95	118	150	190	236	300	375
		3	112	140	180	224	280	355	450
		4	125	160	200	250	315	400	500
		6	150	190	236	300	375	475	600
180	355	3	125	160	200	250	315	400	500
		4	140	180	224	280	355	450	560
		6	160	200	250	315	400	500	630

TABLE 4.4
MINOR DIAMETER TOLERANCES FOR INTERNAL THREADS

Pitch <i>P</i> mm	Tolerance, μm				
	Tolerance grade				
	4	5	6	7	8
0.2	38	—	—	—	—
0.25	45	56	—	—	—
0.3	53	67	85	—	—
0.35	63	80	100	—	—
0.4	71	90	112	—	—
0.45	80	100	125	—	—
0.5	90	112	140	180	—
0.6	100	125	160	200	—
0.7	112	140	180	224	—
0.75	118	150	190	236	—
0.8	125	160	200	250	315
1	150	190	236	300	375
1.25	170	212	265	335	425
1.5	190	236	300	375	475
1.75	212	265	335	425	530
2	236	300	375	475	600
2.5	280	355	450	560	710
3	315	400	500	630	800
3.5	355	450	560	710	900
4	375	475	600	750	950
4.5	425	530	670	850	1060
5	450	560	710	900	1120
5.5	475	600	750	950	1180
6	500	630	800	1000	1250

TABLE 4.5
MAJOR DIAMETER TOLERANCES FOR EXTERNAL THREADS

Pitch <i>P</i> mm	Tolerance, μm		
	Tolerance grade		
	4	6	8
0.2	36	56	—
0.25	42	67	—
0.3	48	75	—
0.35	53	85	—
0.4	60	95	—
0.45	63	100	—
0.5	67	106	—
0.6	80	125	—
0.7	90	140	—
0.75	90	140	—
0.8	95	150	236
1	112	180	280
1.25	132	212	335
1.5	150	236	375
1.75	170	265	425
2	180	280	450
2.5	212	335	530
3	236	375	600
3.5	265	425	670
4	300	475	750
4.5	315	500	800
5	335	530	850
5.5	355	560	900
6	375	600	950

TABLE 4.6
LENGTHS OF THREAD ENGAGEMENT

millimetres

Basic major diameter <i>D, d</i>		Pitch <i>P</i>	Length of thread engagement			
			Short	Normal		Long
Over	Up to and including		Up to and including	Over	Up to and including	Over
0.99	1.4	0.2 0.25 0.3	0.5 0.6 0.7	0.5 0.6 0.7	1.4 1.7 2	1.4 1.7 2
1.4	2.8	0.2 0.25 0.35 0.4 0.45	0.5 0.6 0.8 1 1.3	0.5 0.6 0.8 1 1.3	1.5 1.9 2.6 3 3.8	1.5 1.9 2.6 3 3.8
2.8	5.6	0.35 0.5 0.6 0.7 0.75 0.8	1 1.5 1.7 2 2.2 2.5	1 1.5 1.7 2 2.2 2.5	3 4.5 5 6 6.7 7.5	3 4.5 5 6 6.7 7.5
5.6	11.2	0.75 1 1.25 1.5	2.4 3 4 5	2.1 3 4 5	7.1 9 12 15	7.1 9 12 15
11.2	22.4	1 1.25 1.5 1.75 2 2.5	3.8 4.5 5.6 6 8 10	3.8 4.5 5.6 6 8 10	11 13 16 18 24 30	11 13 16 18 24 30
22.4	45	1 1.5 2 3 3.5 4 4.5	4 6.3 8.5 12 15 18 21	4 6.3 8.5 12 15 18 21	12 19 25 36 45 53 63	12 19 25 36 45 53 63
45	90	1.5 2 3 4 5 5.5 6	7.5 9.5 15 19 24 28 32	7.5 9.5 15 19 24 28 32	22 28 45 56 71 85 95	22 28 45 56 71 85 95
90	180	2 3 4 6	12 18 24 36	12 18 24 36	36 53 71 106	36 53 71 106
180	300	3 4 6	20 26 40	20 26 40	60 80 118	60 80 118