

Specification for  
**ISO miniature screw  
threads —**  
Metric series

Confirmed  
January 2012

# 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:

|                                                                                                        |                                                                   |
|--------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| Associated Offices Technical Committee                                                                 | Engineering Equipment Users' Association                          |
| Association of Consulting Engineers                                                                    | Gas Council                                                       |
| Association of Hydraulic Equipment Manufacturers Ltd.                                                  | Institution of Civil Engineers                                    |
| Association of Mining Electrical and Mechanical Engineers                                              | Institution of Gas Engineers                                      |
| British Chemical Plant Manufacturers' Association                                                      | Institution of Heating and Ventilating Engineers                  |
| British Compressed Air Society                                                                         | Institution of Mechanical Engineers (Automobile Division)         |
| British Electrical and Allied Manufacturers' Association                                               | Institution of Plant Engineers                                    |
| British Gear Manufacturers' Association                                                                | Institution of Production Engineers                               |
| British Internal Combustion Engine Manufacturers' Association                                          | Locomotive and Allied Manufacturers' Association of Great Britain |
| British Mechanical Engineering Confederation                                                           | London Transport Executive                                        |
| British Pump Manufacturers' Association                                                                | Machine Tool Trades Association*                                  |
| British Steel Industry                                                                                 | Ministry of Defence                                               |
| Crown Agents for Oversea Governments and Administrations                                               | Ministry of Defence, Army Department*                             |
| Department of Employment and Productivity (HM Factory Inspectorate)                                    | National Coal Board                                               |
| Department of the Environment                                                                          | National Physical Laboratory (Department of Trade and Industry)   |
| Department of Trade and Industry                                                                       | Royal Institute of British Architects                             |
| Department of Trade and Industry — National Engineering Laboratory                                     | Telecommunications Engineering Manufacturing Association          |
| Electricity Council, the Central Electricity Generating Board and the Area Boards in England and Wales | Water-tube Boilermakers' Association                              |

The Government department and industrial organization marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard.

|                                                  |                         |
|--------------------------------------------------|-------------------------|
| British Bolt, Nut, Screw and Rivet Federation    | Smith's Industries Ltd. |
| Fasteners and Turned Parts Institute             | Timex Ltd.              |
| Scientific Instrument Manufacturers' Association |                         |

This British Standard, having been approved by the Mechanical Industry Standards Committee, was published under the authority of the Executive Board on 31 July 1972

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The following BSI references relate to the work on this standard:  
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# Foreword

This standard makes reference to the following British Standards and ISO Recommendation:

BS 919, *Screw gauge limits and tolerances*.

BS 919-3, *Gauges for ISO metric screw threads*.

BS 3643, *ISO metric screw threads*.

BS 4183, *Machine screws and machine screw nuts — metric series*.

ISO/R 1501, *Miniature screw threads*.

This British Standard, which specifies requirements for ISO miniature screw threads from 0.30 mm to 1.4 mm in diameter, has been prepared under the authority of the Mechanical Engineering Industry Standards Committee and is based on ISO/R 1501, “Miniature screw threads”, prepared by Technical Committee ISO/TC1.

These threads are distinguished from ISO general purpose metric screw threads by a reduced basic depth of  $0.48P$  compared with approximately  $0.54P$ . They have been formulated as a result of lengthy consideration of the practical problems involved in the production and use of small screw threads. Tests by the horological industry showed that small internal threads made nominally to the general purpose profile almost invariably required minor diameters considerably larger than basic size if severe difficulties in tapping were to be avoided, and that these larger minor diameters corresponded to a thread depth in the region of  $0.48P$ . This enables the minor diameters of the taps and external threads to be increased to the benefit of core strength, productivity and tool life but at the cost of thread overlap (depth of engagement).

In the range below 1.0 mm diameter the ISO miniature screw threads specified in this standard form part of the complete series of the metric screw threads recommended by ISO.

In the range from 1.0 mm to 1.4 mm diameter ISO general purpose metric screw threads to BS 3643<sup>1)</sup> are recommended for standard screws and nuts (for example to BS 4183<sup>2)</sup>) but the miniature screw thread form incorporated in this standard is available for use where the reduction of thread overlap is acceptable.

This standard supersedes BS 3369, “*Unified miniature screw threads*”, which was an attempt to reconcile the ISO/Unified thread form with American Standard B1.10:1958, “*Unified machine screw threads*” having a basic thread depth of  $0.52P$ .

The Swiss Horological Industry Standards NIHS 06-02 and 06-05 are in conformity with the ISO Recommendation and it is understood that the American Standard is being revised to incorporate the new profile, even though it may differ from the ISO Recommendation in some other respects without affecting interchangeability between threads of the same diameter and pitch.

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.

<sup>1)</sup> BS 3643, “*ISO metric screw threads*”.

<sup>2)</sup> BS 4183, “*Machine screws and machine screw nuts — metric series*”.

## 1 Scope

This British Standard specifies requirements for ISO miniature screw threads from 0.30 mm to 1.4 mm in diameter with 60° ISO miniature screw thread form specified in ISO/R 1501 and conforms dimensionally with it.

## 2 Thread form and diameter-pitch combinations

**2.1 Basic profile.** The basic profile, shown in Figure 1, is the theoretical profile of depth  $0.48P$  associated with the basic sizes of the major, pitch and minor diameters of the thread. The fundamental deviations, which in this standard are zero for external thread (bolt) major and pitch diameters and negative for the bolt minor diameter, and which are zero for the internal thread (nut) minor diameter and either zero or positive for the nut pitch and major diameters, are applied to the basic sizes and establish the maximum material limits. The application of tolerances to the maximum material limits, negative for bolts, positive for nuts, determines the minimum material limits. Table 1 includes the basic thread data for each standard pitch.

**2.2 Diameter-pitch combinations.** Table 2 gives the standard series of nominal diameters and their associated pitches with the corresponding basic major, pitch, and minor diameters. The nominal diameters are classified as first or second choice. Sizes 1.0 mm to 1.4 mm diameter are all second choice because ISO metric general purpose screw threads to BS 3643 are recommended for standard screws and nuts (for example, BS 4183).

**2.3 Maximum and minimum material profiles.** Figure 2 and Figure 3 for nuts and Figure 4 for bolts show the maximum and minimum material profiles derived from the basic profile as described in 2.1 above. Table 1 includes data for the maximum material depth of the bolt,  $0.56P$ , and the root radius of approximately  $0.2P$  associated with it. This root radius is not tangential to the flanks of the thread. Roots of bolts must lie between the maximum material root profile with  $0.2P$  radius and a minimum material root profile having a flat minor diameter. Crests of bolts must lie between maximum and minimum material profiles having flat major diameters. In practice, bolt crests and roots are seldom truly flat or truly radiused, but it is desirable that they are rounded. The maximum material major diameters of nuts are flat but these are in practice cleared by taps having crests of approximately  $0.07P$  radius.

## 3 Limits and tolerances

**3.1 Fundamental deviations, tolerance grades and positions, tolerances, limits of size.** In the case of nuts, tolerance position H indicates zero fundamental deviation for all elements of the thread and thus maximum material limits equal to basic size. No minimum material limit is specified for the major diameter  $D$ , one grade of tolerance, i.e. 4, is specified for the pitch diameter  $D_2$ , and two grades of tolerance, 5 and 6, are specified for the minor diameter  $D_1$ . These details together with the limits of size are shown in Table 3 and Table 4.

Also for nuts, tolerance position G indicates positive fundamental deviations  $DEI$  and  $D_2EI$  for the maximum material limits of the major diameter  $D$  and the pitch diameter  $D_2$ , but with zero fundamental deviation for the minor diameter  $D_1$  so that the maximum material limit of  $D_1$  is basic size (as for tolerance position H). No minimum material limit is specified for the major diameter  $D$ , one grade of tolerance, i.e. 3, is specified for the pitch diameter  $D_2$ , and two grades of tolerance, 5 and 6, are specified for the minor diameter  $D_1$ . These details, together with the limits of size, are shown in Table 5 and Table 6.

The two grades of tolerance, 5 and 6, provided in Table 3 – Table 6 for the nut minor diameters  $D_1$  are not so much a measure of quality as a recognition of the practical difficulties met with in tapping miniature screw threads in more difficult materials or deep holes. The use of the grade 6 tolerances provided for sizes from 0.40 mm to 1.4 mm diameter makes it possible to increase tapping hole sizes and so to alleviate the difficulties mentioned.

It will be seen from Table 3–Table 6 that the maximum (i.e. minimum material) pitch diameters  $D_2$  are the same throughout, the difference between the Grade 4 tolerances of Table 3 and Table 4, and the Grade 3 tolerances of Table 5 and Table 6, lying in the clearance provided in Table 5 and Table 6 at the minimum (i.e. maximum material) pitch diameters by the fundamental deviations  $D_2EI$ . A similar clearance is provided at the minimum major diameter  $D$ . No such clearance is provided at the minimum minor diameter  $D_1$ .

NOTE The necessity for this clearance has given rise to some controversy. However, the practical result of working to Table 3 and Table 4 will adequately ensure compatibility. The Swiss Horological Industry on the other hand prefer working to Table 5 and Table 6. In any event users should not indiscriminately specify all four Table 3–Table 6. A choice should be made between (1) using Table 3 normally, with Table 4 in difficult conditions and (2) using Table 5 normally, with Table 6 in difficult conditions.

In the case of bolts, tolerance position h indicates zero fundamental deviation for the major diameter  $d$  and pitch diameter  $d_2$ , and thus maximum material limits equal to basic size. The maximum (i.e. maximum material) limit of the minor diameter  $d_1$  has a negative fundamental deviation of  $0.16P$ , i.e.  $2(0.56P - 0.48P)$  as a result of the specified maximum material bolt thread depth of  $0.56P$ . The tolerance on major diameter  $d$  is Grade 3, on pitch diameter  $d_2$ , Grade 5, and on minor diameter  $d_1$ , Grade 4. These details, together with the limits of size, are shown in Table 7.

**3.2 Thread overlap.** The thread overlap (depth of engagement) between bolts and nuts when assembled concentrically is shown in Figure 5 and Table 8. Designers may find this information useful when deciding, in the range from 1.0 mm to 1.4 mm diameter, whether to use the thread form of this standard or the thread form of the ISO general purpose standard.

4 Designation

**4.1** A complete designation of a thread gives information on the thread system, the size and pitch of the thread and the tolerances applicable to it. ISO/R 1501 omits the pitch from the designation of miniature threads but this British Standard requires its inclusion in all cases.

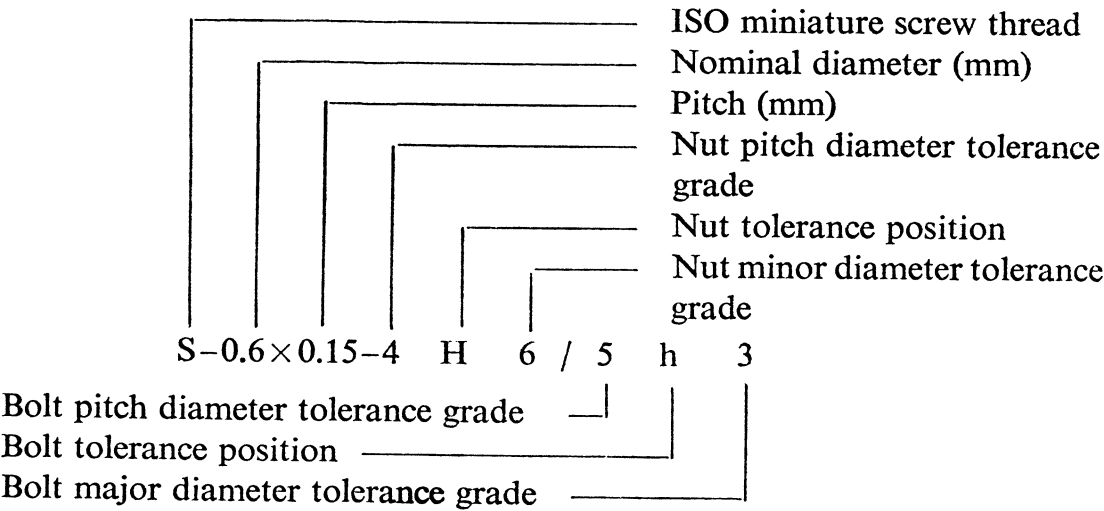
**4.2** Screw threads to this standard are designated by S– followed by the nominal size in millimetres, the pitch, the pitch diameter tolerance grade number, the tolerance position letter (capital for internal threads, lower-case for external threads) and the tolerance grade number for the nut minor diameter or bolt major diameter.

Example for ISO miniature external screw thread S–0.6 mm diameter:

S–0.6 × 0.15 5h3.

**4.3** A fit between mating threads is designated by a combination of the nut and bolt designations in that order.

Example for ISO miniature screw thread S–0.6 mm diameter:



## 5 Inspection

Differences in methods of gauging and measurement have a considerable bearing on tolerances, especially where, as in this case, uncertainties in gauging and measurement may be quite significant in relation to the size of the product and its tolerances.

GO ring screw gauges and GO plug screw gauges for the maximum material limits can be of value provided that they are made to closer tolerances than those in BS 919-3, for the same tolerances. Where pitches do not comply with the requirements of BS 919-3, the tolerances shall be proportionally closer.

It is in the miniature range of screw threads that the NOT GO gauging of minimum material limits becomes of progressively less value, with correspondingly greater reliance having to be placed on skilful and conscientious workmanship and on the accuracy of threading tools.

Whether GO gauges are used or not, it is recommended that external miniature screw threads and the taps for the internal threads be inspected optically by projection or in a toolmaker's measuring microscope. The illuminating beam should be parallel and should be inclined to the axis of the screw at the helix angle of the thread. The image should be compared with a suitable chart to enable the form of the thread, its depth and cumulative pitch to be examined.

A projected image will provide an estimate of the minor and pitch diameters from a previous knowledge of the major diameter obtained from a micrometer measurement but whether inspection is by projection or by microscope the warning given above shall be borne in mind.

Whatever method of inspection is employed should be the subject of agreement between supplier and the purchaser.

## 6 Coated threads

It is obvious that in these small sizes any coatings applied must be kept thin. Allowance shall be made in manufacture for any coating, the maximum material limits given in this standard being applicable to both plated and unplated threads.