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BRITISH STANDARD 1083: 1951

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PRECISION HEXAGON
BOLTS, SCREWS, NUTS
(B.S.W. AND B.S.F. THREADS)
~~AND PLAIN WASHERS~~



BRITISH STANDARDS INSTITUTION

BRITISH STANDARD SPECIFICATION

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(B.S.W. AND B.S.F. THREADS)
~~AND PLAIN WASHERS~~

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Price 4/- net, post free

BRITISH STANDARDS INSTITUTION

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THIS BRITISH STANDARD, having been approved by the Mechanical Industry Standards Committee and endorsed by the Chairman of the Engineering Divisional Council, was published under the authority of the General Council on 31st March, 1951.

The Institution desires to call attention to the fact that this British Standard does not purport to include all the necessary provisions of a contract.

In order to keep abreast of progress in the industries concerned, British Standards are subject to periodical review. Suggestions for improvements will be recorded and in due course brought to the notice of the committees charged with the revision of the standards to which they refer.

A complete list of British Standards, numbering over 1700, indexed and cross-indexed for reference, together with an abstract of each standard, will be found in the Institution's Yearbook, price 5s. post free.

This standard requires reference to the following :—

- B.S. 84. Screw threads of Whitworth form.
- B.S. 93. Screw threads, British Association, with tolerances for sizes Nos. 0 to 15 B.A.
- B.S. 919. Screw thread gauge tolerances.
- B.S. 969. Tolerances for plain limit gauges.
- B.S. 970. V. wrought steels.

British Standards are revised, when necessary, by the issue either of amendment slips or of revised editions. It is important that users of British Standards should ascertain that they are in possession of the latest amendments or edition.

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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
 Air Ministry
 Association of Consulting Engineers (Incorporated)
 Associated Offices Technical Committee
 British Chemical Plant Manufacturers' Association
 British Compressed Air Society
 *British Electrical and Allied Manufacturers' Association
 *British Engineers' Association
 *British Internal Combustion Engine Manufacturers' Association
 *British Iron and Steel Federation
 *British Railways, The Railway Executive
 *Crown Agents for the Colonies
 Department of Scientific and Industrial Research
 *Engineering Equipment Users' Association
 Institute of Marine Engineers
 Institute of Petroleum
 Institution of Civil Engineers
 Institution of Gas Engineers
 Institution of Heating and Ventilating Engineers
 Institution of Mechanical Engineers
 Institution of Mechanical Engineers (Automobile Division)
 *Institution of Production Engineers
 *Locomotive Manufacturers' Association
 *Machine Tool Trades' Association
 Ministry of Fuel and Power
 Ministry of Labour and National Service (Factory Department)
 *Ministry of Supply
 Ministry of Transport
 Ministry of Works
 *Office of the High Commissioner for India
 War Office

The Government departments and scientific 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 British Standard :—

Aircraft Bolt and Nut Manufacturers' Association
 Bright Bolt and Nut Manufacturers' Association
 Bright Steel Bar Association
 British Constructional Steelwork Association
 British Cycle and Motor Cycle Manufacturers' and Traders' Union Ltd.
 British Steel Wire Industries Association
 Cold Headed Heat-treated Bolt Association
 Council of British Manufacturers of Petroleum Equipment
 General Post Office
 Institution of Naval Architects
 Metal Thread Screw Manufacturers' Association (Rolled Screw Section)
 Metal Thread Screw Manufacturers' Association (Turned Screw Section)
 National Physical Laboratory
 Oil Companies' Materials Committee
 Radio Industry Council
 Society of British Aircraft Constructors
 Society of Motor Manufacturers and Traders Ltd.
 Telecommunications Engineering and Manufacturing Association
 Washer Manufacturers' Association

BRITISH STANDARD SPECIFICATION FOR PRECISION HEXAGON BOLTS, SCREWS, NUTS (B.S.W. AND B.S.F. THREADS) AND PLAIN WASHERS

FOREWORD

This British Standard has been prepared under the authority of the Mechanical Engineering Industry Standards Committee to supersede :

- B.S. 190 : 1924. B.S. Whitworth (B.S.W.) bright hexagon bolts, set-screws and nuts, split-pins, washers and studs.
- B.S. 191 : 1924. British Standard fine (B.S.F.) bright hexagon bolts, set-screws and nuts, split-pins, washers and studs.
- B.S. 193 : 1929. B.S. Whitworth (small hexagon) (B.S.W.S.) bright hexagon bolts, nuts and set-screws, split-pins, washers and studs.
- B.S. 1083 : 1942. Bolts, nuts and set-screws (machine bolts) B.S.W. and B.S.F.

In 1942, at the request of the Ministry of Supply, B.S. 190 relating to bolts and nuts of the full Whitworth dimensions was withdrawn. The war emergency B.S. 1083 was prepared and issued as a revision of B.S. 191 and B.S. 193 and, during the period of the war, was the sole operative British Standard for bright bolts and nuts for general engineering purposes. In that standard the dimensions for the B.S.W. threaded bolts and nuts were those formerly designated 'small hexagon' in B.S. 193, and were identical with the dimensions of B.S.F. threaded bolts and nuts.

The withdrawal of B.S. 190 and the establishment of B.S. 1083 as the sole operative British Standard were undertaken partly to save steel and partly because the type of bolt and nut covered by B.S. 1083 could be more easily and more efficiently produced by modern methods of manufacture.

At the end of the war, the question of the most suitable post-war British Standard for bright bolts and nuts was discussed, and after consultation with a wide field of user interests, it was agreed that B.S. 1083 be re-issued as the regular British Standard.

In making this decision it was realized that there were certain applications for which the use of the old full Whitworth size B.S.W. bolts and nuts might be desirable; for such applications the manufacturers are prepared to continue to supply bolts and nuts to the basic dimensions of the former B.S. 190.

In re-issuing B.S. 1083 as a regular British Standard the opportunity

has been taken to introduce certain amendments. The basic dimensions remain unchanged, and the amendments are concerned principally with a clarification of certain of the former requirements and the inclusion of additional requirements to improve the general quality of the bolts and nuts.

The term 'precision bolts' is now used to designate the type of bolts (together with the corresponding screws and nuts) dealt with in this British Standard, namely, those which are manufactured to prescribed mechanical properties and to tolerances required for use in engineering work where a good standard of dimensional accuracy and performance is required.

The class of bolt required for use where closely controlled mechanical properties and a high standard of dimensional accuracy are not essential, is covered by B.S. 916, 'Black bolts and nuts.'

In previous editions of the standards relating to bolts and nuts, brief dimensional standards were included in regard to studs. These have been omitted from the present standard as it is considered that the subject requires more detailed study; it is intended to issue a separate comprehensive British Standard for studs in due course.

It has for many years been the practice of the Institution to recommend the use of 2 B.A. bolts, screws and nuts in place of $\frac{3}{16}$ in. B.S.W. and B.S.F. Reference should be made to B.S. 57 for the full details of B.A. bolts, screws and nuts, but the principal general dimensions of 2 B.A. hexagon bolts, screws and nuts have been included in the present standard for ready reference.

Attention is drawn to the following British Standards relating to bolts, nuts, etc. :—

- B.S. 57. B.A. screws, bolts, nuts and washers.
- B.S. 325. Black cup and countersunk bolts, nuts and washers.
- B.S. 450. Bright countersunk, round and cheese head screws.
- B.S. 451. Square head screws.
- B.S. 768. Grub screws.
- B.S. 856. Wing nuts.
- B.S. 916. Black bolts and nuts (including square nuts and washers).
- B.S. 1574. Split cotter pins.
- *B.S. Socket screws.

SPECIFICATION

SECTION ONE : GENERAL

SCOPE

1. The dimensional requirements of this standard apply to both ferrous and non-ferrous bolts, screws and nuts, and to split cotter pins and washers

* In course of preparation.

to be used with them. Mechanical properties are given only in respect of steel bolts, screws and nuts.

Steel precision bolts, screws and nuts are supplied in the following conditions :—

a. Precision bolts and screws (heat-treated). The surfaces of these bolts and screws are characteristically dull black from heat-treatment, although the manufacturer may machine some of the surfaces of the bolts and screws of the larger sizes after heat-treatment.

b. Precision bolts and screws (bright finished). These bolts and screws are machined on all surfaces.

NOTE. The finish normally produced on the hexagons by bright drawing is, for the purpose of this description, regarded as a 'machined' finish.

c. Precision nuts. These nuts are bright on all surfaces.

If steel bolts or screws are required bright all over, the purchaser should state in his enquiry and order that he requires 'precision bolts (bright finished)' or 'precision screws (bright finished)'.

SECTION TWO : BOLTS, SCREWS AND NUTS

MATERIAL

2. The steel used for the manufacture of the bolts, screws and nuts shall be such that the finished products possess the mechanical properties appropriate to the particular class of bolts, screws and nuts ordered by the purchaser, as designated by the code symbol, and as set out in Tables 9 and 10 of Appendix A.

If the bolts and screws are produced by cold-forging they shall, except in the case of precision bolts and screws bright finished to code symbol A (see Appendix A), be heat-treated after forging. Bolts, screws and nuts produced by hot-forging or turning from the bar shall be heat-treated when this is necessary to give the requisite mechanical properties.

NOTE 1. B.S. 970 : 'Wrought steels', does not specifically include steels suitable for the cold-forging of bolts and screws but it is expected that provision for such steels will be made by the issue of amendments to that specification.

NOTE 2. In B.S. 57, 'B.A. Screws, bolts, nuts and washers,' the material from which 2 B.A. bolts, screws and nuts are manufactured is required to have a minimum ultimate tensile stress as follows :—

Steel	25 tons/sq. in.
Brass	20 tons/sq. in.
Aluminium alloy	20 tons/sq. in.

FINISH

3. The bolts, screws and nuts shall be cleanly finished, sound and free from defects.

DIMENSIONS

4. The bolts, screws and nuts shall conform to the dimensions and tolerances given in Tables 1 to 6 inclusive, and Clauses 5 to 11 inclusive.

NOTE. It is recommended that 2 B.A. bolts, screws and nuts be used in place of $\frac{3}{16}$ in. B.S.W. and B.S.F. The dimensions of 2 B.A. bolts, screws and nuts (reproduced from B.S. 57, to which reference should be made for full details) are accordingly included in this standard for ready reference.

LENGTH OF BOLTS AND SCREWS

5. *a.* The nominal length of a bolt or screw shall be the distance from the underside of the head to the extreme end of the shank including any chamfer or radius.

NOTE. The nominal lengths of bolts and screws normally stocked are given in Appendix B.

b. The permissible tolerance on the nominal length shall be :

(i) *B.S.W. bolts as given in Table 2, B.S.F. long bolts as given in Table 3 and all screws (except 2 B.A.).*

Nominal length	Diameter	Tolerance on length
in.	in.	in.
Up to and including 4	Up to and including $\frac{1}{2}$	$+\frac{1}{16} - 0$
	$\frac{9}{16}$ and up to and including $\frac{3}{4}$	$+\frac{3}{32} - 0$
	$\frac{7}{8}$ and over	$+\frac{1}{8} - 0$
Over 4	All diameters	$+\frac{1}{8} - 0$

(ii) *B.S.F. short bolts as given in Table 4.*

Diameter	Tolerance on length
$\frac{1}{2}$ in. and under	$+\frac{1}{32}$ in. — 0.
$\frac{9}{16}$ in. and over	$+\frac{1}{16}$ in. — 0.

(iii) *2 B.A. bolts and screws.*

Nominal length	Tolerance on length
$\frac{1}{4}$ in. up to and including $\frac{1}{2}$ in.	$+0.02$ in. — 0.
Above $\frac{1}{2}$ in.	$+\frac{1}{32}$ in. — 0.

ENDS OF BOLTS AND SCREWS

6. The ends of bolts and screws may, at the option of the manufacturer, be finished with either a flat chamfer with a 90° included angle to a depth slightly exceeding the depth of thread or a radius approximately equal to $1\frac{1}{4}$ times the nominal diameter of shank. When bolts and screws are made with rolled threads the lead formed at the end of the bolt or screw by the thread rolling operation may be regarded as providing the necessary chamfer to the end, no other machining operation being necessary, and the end shall be reasonably square with the centre line of the shank.

SCREW THREADS

7. *a. General.* The screw threads shall be B.S.W., B.S.F., or 2 B.A., as specified by the purchaser.

b. Bolts and screws. The screw threads may be either cut or rolled, at the option of the manufacturer, and shall conform to the limits and tolerances for 'medium fit' specified in B.S. 84, 'Screw threads of Whitworth form,' or B.S. 93, 'Screw threads, British Association, with tolerances for sizes Nos. 0 to 15 B.A.'

c. Nuts. The screw threads shall conform to the limits and tolerances for 'free fit' specified in B.S. 84, and in the case of 2 B.A., in B.S. 93.

LENGTH OF THREAD AND LENGTH OF UNTHREADED SHANK
UNDER THE HEAD

8. *a. Long bolts, i.e. B.S.W. and B.A. bolts as given in Table 2 and B.S.F. long bolts as given in Table 3.* The length of thread on long bolts (see Tables 2 and 3) shall be the distance from the end of the bolt (including any chamfer or radius) to the leading face of a nut which has been screwed as far as possible on to the bolt by hand. The nut for this test shall have threads as specified in Clause 7c and shall not be countersunk.

b. Short bolts as given in Table 4, B.S.F. only. The length of thread on short bolts is not specified but these bolts shall be threaded to leave a limited length of unthreaded shank under the head (see Table 4). The length of unthreaded shank shall be the distance from the underside of the head to the leading face of a nut which has been screwed by hand, as far as possible on to the bolt. The nut for this test shall have threads as specified in Clause 7c and shall not be countersunk.

c. Screws. Screws shall be threaded to permit of a nut being screwed by hand to within a distance from the underside of the head as given below. The nut for this test shall have threads as specified in Clause 7c and shall not be countersunk.

(i) B.S.F. and B.S.W. To within twice the pitch.

(ii) 2 B.A.

Nominal lengths up to and including 5 times the diameter	to within $1\frac{1}{2} \times$ pitch
Nominal lengths greater than 5 times the diameter	to within $2\frac{1}{2} \times$ pitch

NUTS—SQUARENESS OF FACE TO THREAD

9. The axis of the thread of the nut shall be square to the face of the nut subject to the 'squareness tolerance' specified in Table 5, Col. 11 and Table 6, Col. 16.

The nut shall be screwed by hand on to a tapered truncated screw gauge until the thread of the nut is tight on the thread of the screw gauge. A sleeve, sliding on a parallel extension of the tapered screw gauge, and which has a face diameter equal to the minimum distance across flats of the nut and exactly at 90° to the axis of the screw gauge, shall be brought into contact with the leading face of the nut. With the sleeve in this position it shall not be possible for a feeler gauge of thickness equal to the 'squareness tolerance' to enter anywhere between the leading face of the nut and the face of the sleeve. (See Fig. 11.)

NOTE. This Clause does not apply to 2 B.A. nuts.

CHAMFERING AND WASHER-FACING

10. *a. Bolts and screws.* Bolt heads and screw heads shall have a chamfer of approximately 30° on their upper faces, and, at the option of the manufacturer (see note at end of this clause) they may, in addition, have a washer-face or (with the exception of 2 B.A.) a chamfer of approximately 15° on the underside.

b. Ordinary nuts. 2 B.A. ordinary nuts shall have a chamfer of approximately 30° on both faces. All other ordinary nuts shall have a chamfer of approximately 30° on their upper faces, and, at the option of the manufacturer (see note) nuts up to and including 1½ in. nominal size may, in addition, have a similar chamfer or a washer-face on their lower faces.

c. Lock nuts. Lock nuts shall have a chamfer of approximately 30° on both faces.

d. Slotted nuts. Slotted nuts shall have a chamfer of approximately 30° on their upper faces, and, at the option of the manufacturer (see note) nuts up to and including 1½ in. nominal size may, in addition, have a similar chamfer or a washer-face on their lower faces.

e. Castle nuts. Castle nuts shall have the sharp edge on their upper faces removed, and, at the option of the manufacturer (see note) nuts up to and including 1½ in. nominal size may, in addition, have a chamfer