

Specification for

ISO metric black cup and countersunk head bolts and screws with hexagon nuts

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British Gear Manufacturers' Association	Institution of Mechanical Engineers (Automobile Division)
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The Government departments and scientific and industrial 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.

Agricultural Engineers Association	Institute of Iron and Steel Wire Manufacturers
Black Bolt and Nut Association of Great Britain	Institution of Engineers and Shipbuilders in Scotland
British Bolt, Nut, Screw and Rivet Federation	United Society of Boilermakers and Iron and Steel Shipbuilders
British Constructional Steelwork Association Ltd.	
British Railways Board	

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Foreword

This British Standard has been prepared under the authority of the Mechanical Engineering Industry Standards Committee to provide a metric series standard corresponding to BS 325:1947 (obsolescent).

There are no ISO Recommendations, or Draft Recommendations, relating to the head and neck dimensions of cup and countersunk head bolts, and so DIN standards 603, 604, 605, 607 and 608 and N.F standards E27 113 342, 351 and 354 have been referred to when establishing the head and neck dimensions for this standard. This item is included in the ISO/TC 2 programme of work.

The hexagon nuts specified for use with the bolts are the same as those in BS 4190:1967.

The following ISO Recommendations have been used in the preparation of the standard.

ISO/R 225, *Bolts, screws and studs. Dimensioning.*

ISO/R 898/I, *Mechanical properties of fasteners. Part 1. Bolts, screws and studs.*

ISO/R 888, *Nominal lengths for bolts, screws and studs. Thread lengths for general purpose bolts.*

Agreement has yet to be reached internationally on several items, such as the tolerances on nominal lengths, thread lengths and concentricity, but wherever possible information on these matters has been provided based on proposals at present before ISO/TC 2 for adoption.

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 18, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

1.1 This British Standard provides general dimensions and tolerances for the following types of cup head and countersunk head bolts and screws

- cup head bolts with nibs
- cup head square neck bolts
- 90° countersunk head bolts and screws
- 90° countersunk head bolts with nibs
- 90° countersunk head square neck bolts
- 120° countersunk head square neck bolts

1.2 Mechanical properties are given for steel bolts and screws which may be produced by hot or cold forging at the option of the manufacture.

NOTE 1 The titles of the British Standards referred to in this standard are listed on the inside back cover.

NOTE 2 It is considered that the range of nominal sizes included in this standard is adequate for most of the applications for which this series is likely to be employed, but for the convenience of users requiring larger sizes, further information is provided in Appendix B.

2 Finish

2.1 General. The bolts and screws and nuts shall be cleanly finished, sound and free from harmful defects.

2.2 Coated finishes. If the purchaser requires the bolts or screws to be coated he should state the type of coating required in his enquiry or order. Where possible reference should be made to the appropriate British Standard, i.e. BS 729 and BS 3382.

3 General dimensions

The general dimensions and tolerances of bolts and screws shall be in accordance with Table 1 to Table 3 and Table 5 to Table 11 and Clauses 4 to 7.

4 Length of bolts and screws

In the case of cup head bolts and screws, the nominal length shall be the distance from the underside of the head to the extreme end of the shank, including any chamfer or radius.

In the case of countersunk head products, the nominal length shall be the distance from the upper face of the head to the extreme end of the shank, including any chamfer or radius.

Standard nominal lengths are not specified in this standard, it may however, as a result of experience of usage, be possible to include these details at a future revision.

The permissible tolerance on nominal length shall be as given in Table 1.

Table 1 — Tolerances on nominal lengths

All dimensions are in mm.

Length <i>L</i>		Tolerances
Over	Up to and including	
10	18	± 0.90
18	30	± 1.05
30	50	± 1.25
50	80	± 1.50
80	120	± 1.75
120	180	± 2.00
180	250	± 2.30
250	315	± 2.60
315	400	± 2.85
400	500	± 3.15

5 Ends of bolts and screws

The ends of the bolts and screws may, at the option of the manufacturer, be finished with either a 45° chamfer slightly exceeding the depth of thread, as shown in Figure 2, or with a radius approximately equal to 1.25 times the nominal diameter of the shank as shown in Figure 1. Where bolts 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 at the end as shown in Figure 3, no other machining operation being necessary. The end shall be reasonably square with the centre line of the shank.

6 Screw threads

6.1 General. The form of thread, diameters and associated pitches shall be in accordance with BS 3643-1 and BS 3643-2. Coarse pitch series threads only shall be used.

6.2 Tolerances. The thread tolerance class for bolts and screws shall be 8g; refer to BS 3643-2.

7 Length of thread

7.1 Bolts. The length of thread on bolts shall be the distance from the end of the bolt (including any chamfer or radius) to the leading face of a screw ring gauge which has been screwed as far as possible onto the bolt by hand.

7.1.1 The lengths of thread shall be as follows.

All bolts except cup head square neck bolts: as in Table 3A.

Cup head square neck bolts: as in Table 3B.

7.1.2 The length of thread run-out on bolts shall not exceed the values given in Table 4.

7.1.3 Bolts which are too short for minimum thread lengths shall be threaded as screws and shall be designated as screws.

7.2 Tolerances. The tolerance on bolt thread lengths shall be plus two pitches for all diameters.

7.3 Screws. Screws shall be threaded to permit a screw ring gauge to be screwed by hand to within a distance, not exceeding the values given in Table 4, from the underside of the head.

8 Nuts

Hexagon nuts suitable for use with the bolts and screws specified in this standard shall be black normal thickness nuts, strength grade designation 4, in accordance with BS 4190.

This type of nut will be provided with the bolts and screws supplied to this standard unless the purchaser in the enquiry or order states otherwise.

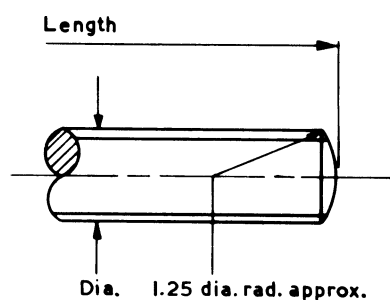


Figure 1 — Points, rounded end

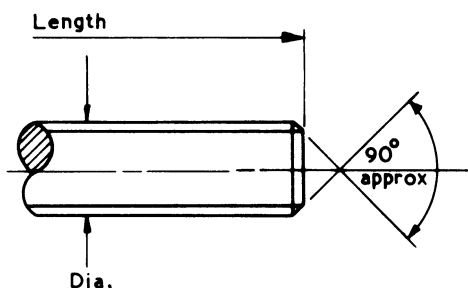


Figure 2 — Points, chamfered end

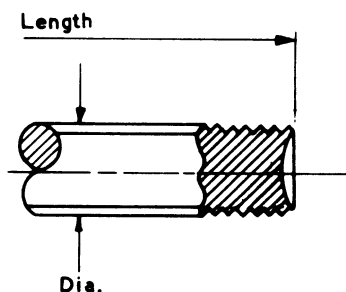


Figure 3 — Points, rolled thread end

9 Strength grade designation system for steel bolts and screws

Being in accordance with ISO/R 898, the strength grade designation system for steel bolts and screws consists of two figures. The first is one-hundredth of the minimum tensile strength in N/mm^2 , and the second is one-tenth of the ratio between the minimum yield stress and the minimum tensile strength, expressed as a percentage (see Table 2). This is illustrated below for strength grade 4.6

1/100 minimum tensile strength of 400 N/mm^2 gives the symbol “4”

1/10 ratio $\frac{\text{yield stress}}{\text{minimum tensile strength}} \times 100 = \frac{1}{10} \times \frac{240}{400} \times \frac{100}{1}$ gives the symbol “6”.

Therefore the strength grade designation is “4.6”.

The product of the two numbers, multiplied by 10, will give the yield stress in N/mm^2 .

NOTE The figure 400 is obtained by rounding off 392, and 240 is obtained by rounding off 235

Table 2 — Strength grade designations for steel bolts and screws

Strength grade designation		4.6	4.8
Tensile strength R_m min.	N/mm^2	392	392
Yield stress R_e min.	N/mm^2	235	314

10 Manufacture, material and strength grades of steel bolts and screws

10.1 Method of production. Bolts and screws may be produced by hot or cold forging at the discretion of the manufacturer.

10.2 Material. Steels shall be selected to provide the required mechanical properties in the finished products. (See Table 12). The maximum sulphur and phosphorus content of the steel shall not exceed 0.06 % each.

10.3 Strength grades. At the option of the manufacturer the strength grades shall be:

4.6 or 4.8

(See Table 4).

11 Mechanical properties of steel bolts and screws

11.1 Steel bolts and screws shall comply with the requirements for mechanical properties given in Table 12. The choice of testing programme A or B as shown in Table 13 is at the option of the supplier unless specially agreed between the purchaser and the supplier. The mechanical properties of bolts to be decisive for acceptance are shown in Table 13. They have been arranged in four groups marked I to IV according to the manner in which they are related to one another.

11.2 In each group the test marked “•” in Table 13 is decisive for acceptance.

11.3 Should the purchaser wish to simplify the acceptance test, the above mentioned tests may be replaced by those marked “⊕” in Table 13. Where doubt exists, the first mentioned tests are decisive unless it is impossible to carry them out for dimensional reasons (e.g. if the bolts are too short or too big). In these cases the test marked “⊕” shall be decisive.

11.3.1 Subject to special agreement tests in Table 13 marked “o” may be included in addition or they may replace the tests marked “•”.

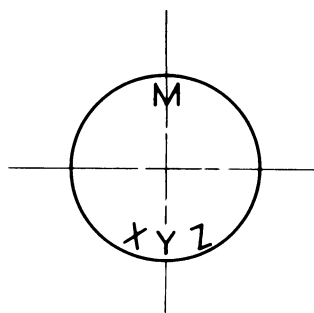
11.3.2 The tests shall be made in accordance with the requirements of Appendix A.

12 Marking and identification

Cup head bolts and screws of diameters 6 mm or larger, shall be identified as being ISO metric by having the symbol “M” embossed or indented on the top of the head. (see Figure 4.)

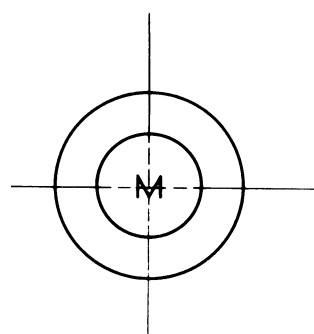
Countersunk head bolts in diameters 6 mm or larger shall be identified as being ISO metric, by having the symbol “M” indented in the top of the head, or embossed in a shallow recess, providing the embossed symbol does not protrude above the face of the head. (See Figure 5.)

The manufacturer’s identification or trade mark shall also be marked on cup head bolts or screws when the normal production process permits and at the option of the manufacturer.



NOTE XYZ refers to manufacturer’s marking. See clause 12.

Figure 4 — Example of marking of cup-head bolts and screws



NOTE Letter M embossed in shallow recess, and is not to protrude above face of head.

Figure 5 — Example of marking of countersunk head bolts and screws