

BS 3692:2014



BSI Standards Publication

ISO metric precision hexagon bolts, screws and nuts – Specification

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Summary of pages

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Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 31 October 2014. It was prepared by Technical Committee FME/9, *Nuts and accessories*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This British Standard supersedes BS 3692:2001, which is withdrawn.

Relationship with other publications

This British Standard should be read in conjunction with BS EN ISO 898-1 as it contains tables that reflect up-to-date best practice for mechanical properties of bolts.

Information about this document

The mechanical properties of the nuts in this British Standard do not conform to BS EN ISO 898-2. Higher proof load values have been allocated to the revised property classes in BS EN ISO 898-2 in order to ensure that fracture of the bolt generally occurs in the case of overloading.

CAUTION. Nuts in accordance with this standard cannot be fully loaded with sufficient assurance up to the yield point of the appropriate bolt, or beyond this, without the possibility of the nut thread being stripped, and for this reason it is essential that new designs of nuts for use with BS 3692 bolts and studs conforming to this standard conform to BS EN ISO 898-2.

In order to differentiate nuts that conform to this British standard from those that conform to BS EN ISO 898-2 vertical bars have been added to the symbols for strength grade designations e.g. I8I instead of 8.

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Requirements in this standard are drafted in accordance with *Rules for the structure and drafting of UK standards*, subclause J.1.1, which states, "Requirements should be expressed using wording such as: 'When tested as described in Annex A, the product shall ...'". This means that only those products that are capable of passing the specified test will be deemed to conform to this standard.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

1 Scope

This standard gives the general dimensions and tolerances of precision hexagon bolts, screws and nuts with ISO metric threads in diameters from 1.6 mm to 68 mm inclusive.

This standard specifies mechanical properties of bolts, screws and nuts made of carbon steel and alloy steel when tested at an ambient temperature range of 10 °C to 35 °C.

NOTE 1 Fasteners (the term used when bolts, screws and nuts are considered all together) that conform to the requirements of this standard are evaluated at this ambient temperature range. They might not retain the specified mechanical and physical properties at elevated temperatures and/or lower temperatures.

This standard is not applicable to fasteners used in applications outside of the range –50 °C to +150 °C.

NOTE 2 Fasteners conforming to the requirements of this standard are used in applications ranging from –50 °C to +150 °C. The use of fasteners in applications outside of this range, and up to a maximum temperature of +300 °C, might need to be based on the advice of an experienced fastener metallurgist for determining appropriate choices for a given application.

NOTE 3 Nuts in accordance with this standard cannot be fully loaded with sufficient assurance up to the yield point of the appropriate bolt, or beyond this, without the possibility of the nut thread being stripped, and for this reason it is essential that new designs of nuts for use with BS 3692 bolts and studs conforming to this standard conform to BS EN ISO 898-2.

NOTE 4 Nuts with an effective height of less than 0.6d and/or with a width across flats or outside diameter of less than 1.4d are excluded from the mechanical requirements specified.

The dimensional requirements of this British Standard are also applicable to non-ferrous and stainless steel bolts, screws and nuts.

Information on strength grade designation system for steel bolts and screws can be found in Annex A.

NOTE 5 The range of nominal sizes included in this British Standard is likely to be 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 in relation to the derivation of tolerances is in Annex E.

NOTE 6 In addition to the definitive requirements, this standard also requires the items detailed in Clause 3 to be documented. For compliance with this standard, both the definitive requirements and the documented items have to be met.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 3643-1, *ISO metric screw threads – Part 1: Principles and basic data*

BS 3643-2, *ISO metric screw threads – Part 2: Specification for selected limits of size*

BS EN ISO 898-1:2013, *Mechanical properties of fasteners made of carbon steel and alloy steel – Part 1: Bolts, screws and studs with specified property classes – coarse thread and fine pitch thread*

BS EN ISO 1234, *Split pins*

BS EN ISO 4042, *Fasteners – Electroplated coatings*

BS EN ISO 4759-1:2001, *Tolerances for fasteners – Part 1: Bolts, screws, studs and nuts – Product grades A, B and C*

BS EN ISO 6506-1, *Metallic materials – Brinell hardness test – Part 1: Test method*

BS EN ISO 6506-2, *Metallic materials – Brinell hardness test – Part 2: Verification and calibration of testing machines*

BS EN ISO 6506-3, *Metallic materials – Brinell hardness test – Part 3: Calibration of reference blocks*

BS EN ISO 6506-4, *Metallic materials – Brinell hardness test – Part 4: Table of hardness values*

BS EN ISO 6507-1, *Metallic materials – Vickers hardness test – Part 1: Test method*

BS EN ISO 6507-2, *Metallic materials – Vickers hardness test – Part 2: Verification and calibration of testing machines*

BS EN ISO 6507-3, *Metallic materials – Vickers hardness test – Part 3: Calibration of reference blocks*

BS EN ISO 6507-4, *Metallic materials – Vickers hardness test – Part 4: Tables of hardness values*

BS EN ISO 6508-1, *Metallic materials – Rockwell hardness test – Test method (scales A, B, C, D, E, F, G, H, K, N, T)*

BS EN ISO 6508-2, *Metallic materials – Rockwell hardness test – Verification and calibration of testing machines (scales A, B, C, D, E, F, G, H, K, N, T)*

BS EN ISO 6508-3, *Metallic materials – Rockwell hardness test – Calibration and reference blocks (scales A, B, C, D, E, F, G, H, K, N, T)*

BS EN ISO 10684, *Fasteners – Hot dipped galvanized coatings*

BS ISO 965-5, *ISO general purpose metric screw threads – Tolerances – Limits of sizes for internal screw threads to mate with hot-dip galvanized external screw threads with maximum size of tolerance position h before galvanizing*

3 Information and requirements to be agreed and documented

3.1 Information to be supplied by the purchaser

The following information to be supplied by the purchaser shall be fully documented.

For compliance with the standard both the definitive requirements specified throughout the standard and the following documented items shall be satisfied:

- general product description, i.e. “bolts”, “screws”, “nuts”, “slotted nuts”, etc., and material (if other than steel);
- the letter “M” indicating that the product is ISO metric;
- the nominal size (thread diameter) of the product in mm;
- the nominal length of bolts and screws in mm;
- the number of this British Standard e.g. BS 3692;
- the strength grade symbol;
- whether bolts with split pin holes are required (see 18.1);
- whether bolts, screws or nuts should be coated, and the type of coating to be used (see Clause 19).

EXAMPLE

Bolts 10 mm diameter, 50 mm long, manufactured from steel of strength grade 8.8, would be designated:

“Bolts M10 × 50, 8.8 to BS 3692”.

Nuts 12 mm in diameter, manufactured from steel of strength grade 6, zinc plated, would be designated:

“Nuts M12, 6 to BS 3692, zinc plated to BS EN ISO 4042”.

3.2 Items to be agreed between the manufacturer and purchaser

The following items to be agreed between the contracting parties are specified in the clauses referred to and shall be fully documented. For compliance with the standard both the definitive requirements specified throughout the standard and the following documented items shall be satisfied:

- a) the tolerances on screw threads (see 7.2);
- b) whether free cutting steel is to be used for the manufacture of nuts (see 16.2);
- c) minimum hardness values for nuts which are not proof load tested (see Clause 17).

4 General dimensions

The bolts, screws and nuts shall conform to the general dimensions given in Table 1, Table 3, Table 4, Table 5, and Table 6, and in Clause 5 to Clause 12.

5 Length of bolts and screws**5.1 Nominal length**

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

The standard nominal lengths shall be in accordance with Table 1.

NOTE Preferred nominal lengths of bolts and screws, in association with diameters, are given in Annex D.

5.2 Tolerance on length

The tolerance on the nominal length shall be in accordance with Table 1.

Table 1 Tolerances on the standard nominal lengths of bolts and screws

Dimensions in millimetres			
Nominal length /	Tolerance	Nominal length /	Tolerance
5	±0.24	90	±0.70
6	±0.24	(95)	±0.70
(7)	±0.29	100	±0.70
8	±0.29	(105)	±0.70
(9)	±0.29	110	±0.70
10	±0.29	(115)	±0.70
(11)	±0.35	120	±0.70
12	±0.35	(125)	±0.80
14	±0.35	130	±0.80
16	±0.35	140	±0.80
(18)	±0.35	150	±0.80
20	±0.42	160	±0.80
(22)	±0.42	170	±0.80
25	±0.42	180	±0.80
(28)	±0.42	190	±0.925
30	±0.42	200	±0.925
(32)	±0.50	220	±0.925
35	±0.50	240	±0.925
(38)	±0.50	260	±1.05
40	±0.50	280	±1.05
45	±0.50	300	±1.05
50	±0.50	325	±1.15
55	±0.60	350	±1.15
60	±0.60	375	±1.15
65	±0.60	400	±1.15
70	±0.60	425	±1.25
75	±0.60	450	±1.25
80	±0.60	475	±1.25
85	±0.70	500	±1.25

NOTE 1 Lengths shown in brackets are non-preferred.

NOTE 2 See also Annex D.

6 Ends of bolts and screws

The ends of bolts and screws shall be finished with either a 45° chamfer to a depth slightly exceeding the depths of thread, or a radius approximately equal to one and a quarter times the nominal diameter of the shank; the choice of method being at the discretion of the manufacturer.

When bolts and screws are made with rolled threads, the lead formed at the end of the bolt by the rolling operation may be regarded as providing the necessary chamfer to the end with no other machining operation being necessary, and the end shall be reasonably square with the centre line of the shank (see Figure 1 and Figure 2).

Figure 1 Rounded end

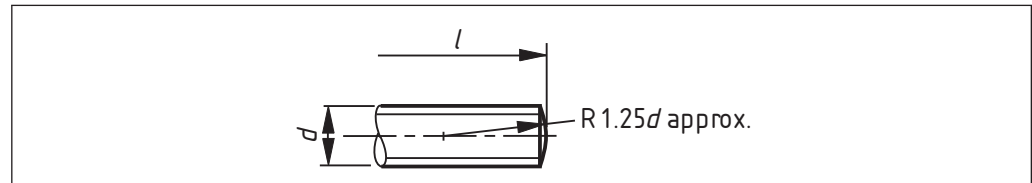
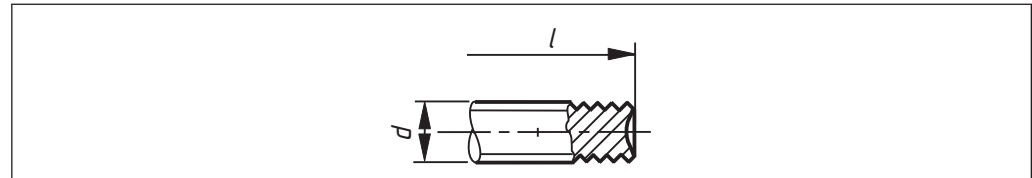


Figure 2 Rolled thread end



7 Screw threads

7.1 General

The form of thread, and diameters and associated pitches of standard ISO metric bolts, screws and nuts shall be in accordance with BS 3643-1.

7.2 Tolerances

Unless otherwise agreed between the purchaser and the manufacturer (see 3.2), the tolerances on the screw threads shall be in accordance with BS 3643-2, as detailed below in Table 2.

Table 2 Thread tolerance classes

Product	Tolerance class
Bolts and screws	6g
Nuts (faced)	6H
Nuts (used with galvanized bolts)	6AZ (in accordance with BS ISO 965-5)

8 Length of thread on bolts and screws

8.1 Bolts

8.1.1 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 on to the bolt by hand.

8.1.2 The standard thread lengths, shall be in accordance with Table 3.

NOTE The values given in Table D.2 are based on the formulae given in Table 3.

Table 3 Basis for standard thread lengths

Nominal length of bolt l	Length of thread b
Up to and including 125 mm	$2d + 6$ mm
Over 125 mm up to and including 200 mm	$2d + 12$ mm
Over 200 mm	$2d + 25$ mm

8.1.3 The length of thread runout shall not exceed the values given in column 3 of Table 4 (see Clause 4).

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

NOTE Further guidance on this is given in Annex D.

8.2 Tolerances

8.2.1 The tolerances on bolt thread lengths shall be plus two pitches for all diameters (see Table D.2).

8.2.2 The eccentricity of the thread relative to the shank of bolts shall not exceed the values given in Table 4b, column 19.

8.3 Screws

Screws shall be threaded to permit a screw ring gauge being screwed by hand to within a distance from the underside of the head not exceeding two and a half times the pitch for diameters up to and including 52 mm and three and a half times the pitch for diameters over 52 mm, in accordance with Table 4a, column 3.

9 Dimensions of bolts and screws

The dimensions of bolts and screws are in Table 4a and Table 4b. Figure 3, Figure 4 and Figure 5 give the explanation for those dimensions.

NOTE See Annex F for the recommended range of sizes for hexagon head bolts.

Figure 3 Hexagon head bolt, washer-faced

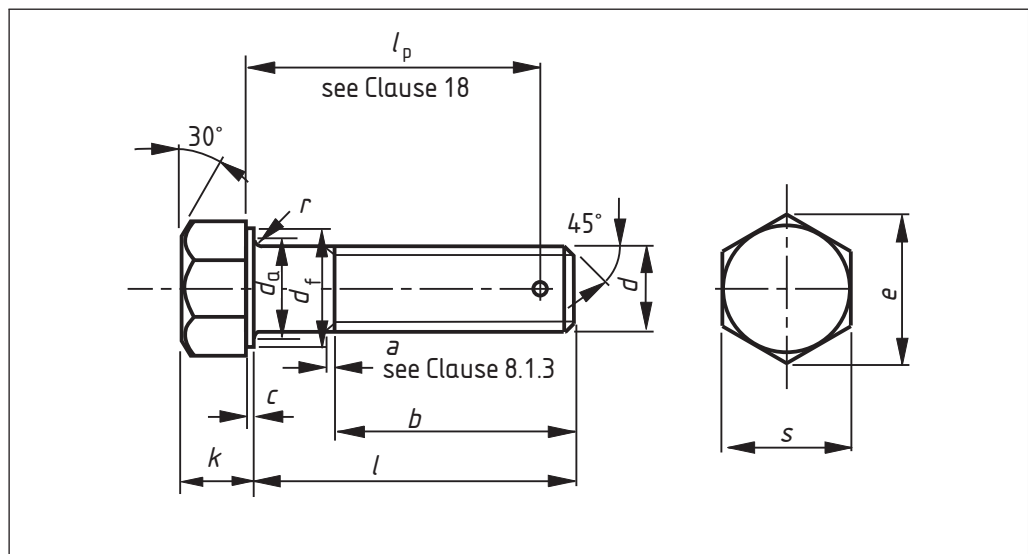


Figure 4 Hexagon head screw, washer-faced

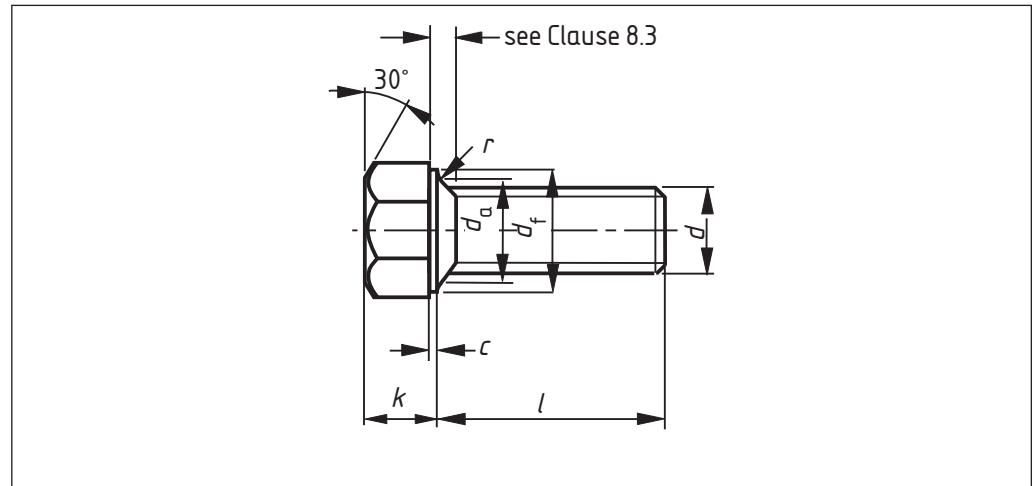


Figure 5 Full bearing head

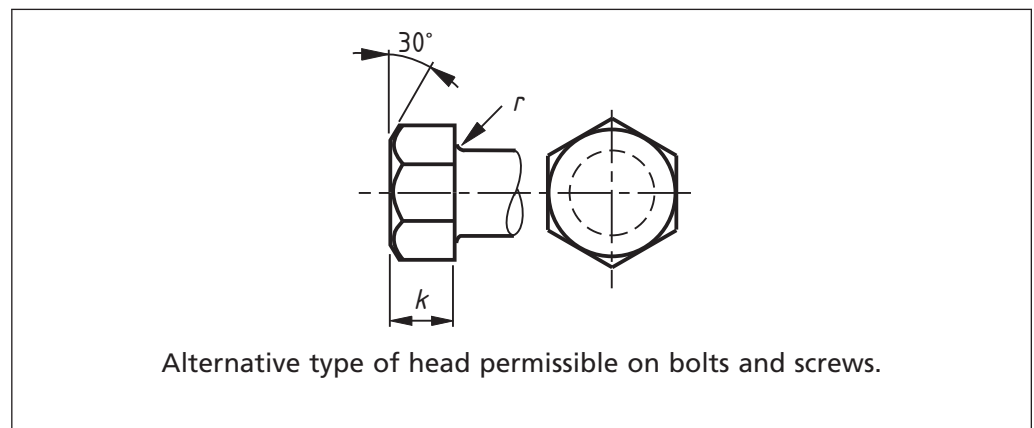


Table 4a ISO metric precision hexagon bolts and screws (1 of 2)

Dimensions in millimetres										
1	2	3	4	5	6	7	8	9	10	11
Nominal size and thread diameter <i>d</i>	Pitch of (thread series)	Thread runout <i>a</i> max.	Diameter of shank <i>d</i>	Diameter of shank <i>d</i>		Width across flats <i>s</i>		Width across corners		Diameter of washer face <i>d</i>
				max.	min.	max.	min.	max.	min.	
M1.6	0.35	0.8	1.6	1.46	3.2	3.08	3.7	3.48	—	—
M2	0.4	1.0	2.0	1.86	4.0	3.88	4.6	4.38	—	—
M2.5	0.45	1.0	2.5	2.23	5.0	4.88	5.8	5.51	—	—
M3	0.5	1.2	3.0	2.86	5.5	5.38	6.4	6.08	5.08	4.83
M4	0.7	1.6	4.0	3.82	7.0	6.85	8.1	7.74	6.55	6.30
M5	0.8	2.0	5.0	4.82	8.0	7.85	9.2	8.87	7.55	7.30
M6	1	2.5	6.0	5.82	10.0	9.78	11.5	11.05	9.48	9.23
M8	1.25	3.0	8.0	7.78	13.0	12.73	15.0	14.38	12.43	12.18
M10	1.5	3.5	10.0	9.78	17.0	16.73	19.6	18.9	16.43	16.18
M12	1.75	4.0	12.0	11.73	19.0	18.67	21.9	21.10	18.37	18.12
(M14)	2	5.0	14.0	13.73	22.0	21.67	25.4	24.49	21.37	21.12
M16	2	5.0	16.0	15.73	24.0	23.67	27.7	26.75	23.27	23.02
(M18)	2.5	6.0	18.0	17.73	27.0	26.67	31.2	30.14	26.27	26.02
M20	2.5	6.0	20.0	19.67	30.0	29.67	34.6	33.53	29.27	28.80
(M22)	2.5	6.0	22.0	21.67	32.0	31.61	36.9	35.72	31.21	30.74
M24	3	7.0	24.0	23.67	36.0	35.38	41.6	39.98	34.98	34.51
(M27)	3	7.0	27.0	26.67	41.0	40.38	47.3	45.63	39.98	39.36
M30	3.5	8.0	30.0	29.67	46.0	45.38	53.1	51.28	44.98	44.36
(M33)	3.5	8.0	33.0	32.61	50.0	49.38	57.7	55.80	48.98	48.36
M36	4	10.0	36.0	35.61	55.0	54.26	63.5	61.31	53.86	53.24
(M39)	4	10.0	39.0	38.61	60.0	59.26	69.3	66.96	58.86	58.24
M42	4.5	11.0	42.0	41.61	65.0	64.26	75.1	72.61	63.76	63.04
(M45)	4.5	11.0	45.0	44.61	70.0	69.26	80.8	78.26	68.76	68.04
M48	5	12.0	48.0	47.61	75.0	74.26	86.6	83.91	73.76	73.04
(M52)	5	12.0	52.0	51.54	80.0	79.26	92.4	89.56	—	—
M56	5.5	19.0	56.0	55.54	85.0	84.13	98.1	95.07	—	—
(M60)	5.5	19.0	60.0	59.54	90.0	89.13	103.9	100.72	—	—
M64	6	21.0	64.0	63.54	95.0	94.13	109.7	106.37	—	—

Table 4a ISO metric precision hexagon bolts and screws (2 of 2)

1	2	3	4	5	6	7	8	9	10	11
Nominal size and thread diameter d	Pitch of (thread series)	Thread runout a	Diameter of shank d	Width across flats s	Width across corners e	Diameter of washer face d	Width across flats s	Width across corners e	Diameter of washer face d	Diameter of washer face d
		max.	max.	min.	max.	min.	max.	min.	max.	min.
(M68)	6	21.0	68.0	67.54	100.0	99.13	115.5	112.02	—	—

NOTE Sizes shown in brackets are non-preferred.

Table 4b ISO metric precision hexagon bolts and screws (1 of 2)

11	12	13	14	15	16	17	18	19
Nominal size and thread diameter d	Depth of washer face c	Transition diameter d_a	Radius under head r	Height of head k	Height of head k	Height of head k	Eccentricity of head max.	Eccentricity of shank and split pin hole to the thread max.
		max.	max.	min.	max.	min.	max.	max.
M1.6	—	2.0	0.2	0.1	1.23	0.98	0.18	0.14
M2	—	2.6	0.3	0.1	1.53	1.28	0.18	0.14
M2.5	—	3.1	0.3	0.1	1.83	1.58	0.18	0.14
M3	0.1	3.6	0.3	0.1	2.13	1.90	0.18	0.14
M4	0.1	4.7	0.35	0.2	2.93	2.68	0.22	0.18
M5	0.2	5.7	0.35	0.2	3.66	3.35	0.22	0.18
M6	0.3	6.8	0.4	0.25	4.15	3.85	0.22	0.18
M8	0.4	9.2	0.6	0.4	5.65	5.35	0.27	0.22
M10	0.4	11.2	0.6	0.4	7.18	6.82	0.27	0.22
M12	0.4	14.2	1.1	0.6	8.18	7.82	0.33	0.27
(M14)	0.4	16.2	1.1	0.6	9.18	8.82	0.33	0.27
M16	0.4	18.2	1.1	0.6	10.18	9.82	0.33	0.27
(M18)	0.4	20.2	1.1	0.6	12.22	11.79	0.33	0.27
M20	0.4	22.4	1.2	0.8	13.22	12.79	0.33	0.33
(M22)	0.4	24.4	1.2	0.8	14.22	13.79	0.39	0.33