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ISO metric precision hexagon bolts, screws and nuts – Specification

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Contents

List of tables

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 40, an inside back cover and a back cover.

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This British Standards supersedes BS 3692:2001, which is withdrawn.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 that those that conform to BS EN ISO 898-2 vertical bars have been added to the symbols for strength grade designations e.g. l8l 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:

a) general product description, i.e. “bolts”, “screws”, “nuts”, “slotted nuts”, etc., and material (if other than steel);

b) the letter “M” indicating that the product is ISO metric;

c) the nominal size (thread diameter) of the product in mm;

d) the nominal length of bolts and screws in mm;

e) the number of this British Standard e.g. BS 3692;

f) the strength grade symbol;

g) whether bolts with split pin holes are required (see **18.1**);

h) 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 in accordance with Table 1.

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

Dimensions in millimetres

Nominal length *l*	Tolerance	Nominal length *l*	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**

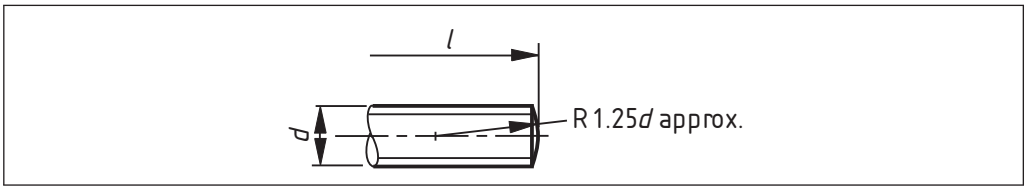
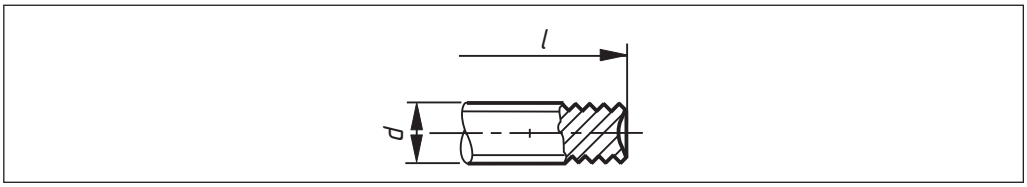


Figure 2 **Rolled thread end**



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	2*d* + 6 mm
Over 125 mm up to and including 200 mm	2*d* + 12 mm
Over 200 mm	2*d* + 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**

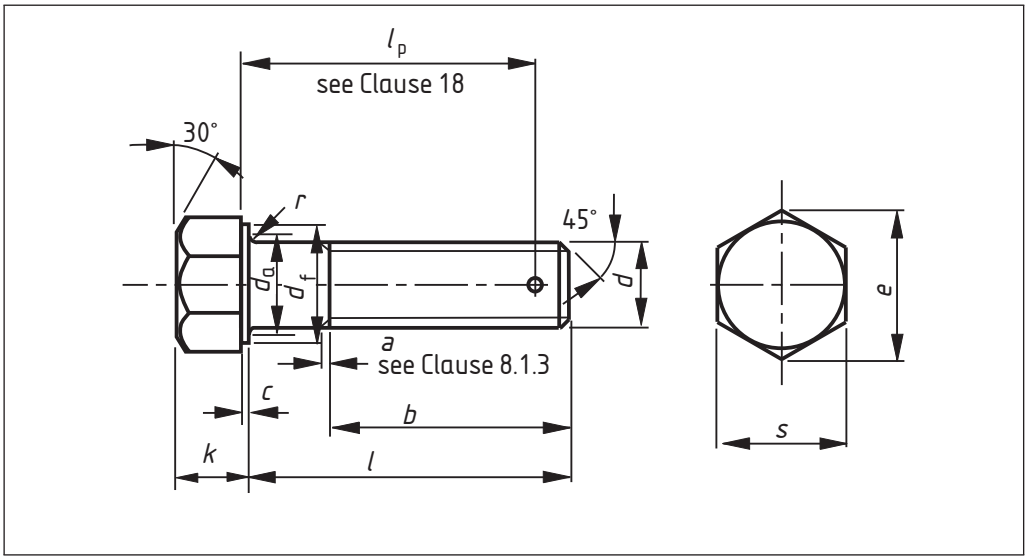


Figure 4 **Hexagon head screw, washer-faced**

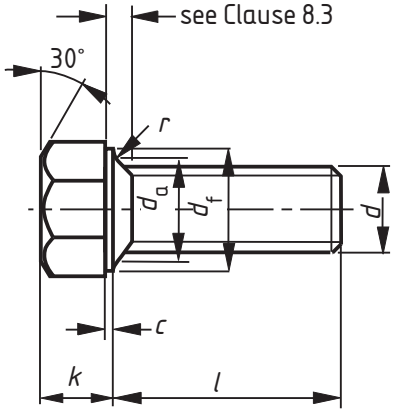
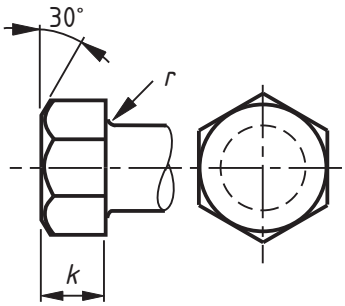


Figure 5 **Full bearing head**



Alternative type of head permissible on bolts and screws.

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 *d*	**Pitch of (thread series)**	**Thread runout** *a* max.	**Diameter of shank** *d*		**Width across flats** *s*		**Width across corners** *e*		**Diameter of washer face** *d*	
			max.	min.	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)*

Dimensions in millimetres

1	2	3	4	5	6	7	8	9	10	11
Nominal size and thread diameter ***d***	**Pitch of (thread series)**	**Thread runout** ***a*** **max.**	**Diameter of shank** ***d***		**Width across flats** ***s***		**Width across corners** ***e***		**Diameter of washer face** ***d***	
			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)*

Dimensions in millimetres

11	12	13	14	15	16	17	18	19
Nominal size and thread diameter ***d***	**Depth of washer face** ***c***	**Transition diameter** d_a **max.**	**Radius under head** ***r***		**Height of head** ***k***		**Eccentricity of head max.**	**Eccentricity of shank and split pin hole to the thread max.**
			max.	**min.**	**max.**	**min.**		
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

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

Dimensions in millimetres

11	12	13	14	15	16	17	18	19
Nominal size and thread diameter ***d***	**Depth of washer face** ***c***	**Transition diameter** d_a **max.**	**Radius under head** ***r***		**Height of head** ***k***		**Eccentricity of head max.**	**Eccentricity of shank and split pin hole to the thread max.**
			max.	**min.**	**max.**	**min.**		
M24	0.5	26.4	1.2	0.8	15.22	14.79	0.39	0.33
(M27)	0.5	30.4	1.7	1.0	17.22	16.79	0.39	0.33
M30	0.5	33.4	1.7	1.0	19.26	18.74	0.39	0.33
(M33)	0.5	36.4	1.7	1.0	21.26	20.74	0.39	0.39
M36	0.5	39.4	1.7	1.0	23.26	22.74	0.46	0.39
(M39)	0.6	42.4	1.7	1.0	25.26	22.74	0.46	0.39
M42	0.6	45.6	1.8	1.2	26.26	25.74	0.46	0.39
(M45)	0.6	48.6	1.8	1.2	28.26	27.74	0.46	0.39
M48	0.6	52.6	2.3	1.6	30.26	29.74	0.46	0.39
(M52)	—	56.6	2.3	1.6	33.21	32.69	0.46	0.46
M56	—	63.0	3.5	2.0	35.31	34.69	0.54	0.46
(M60)	—	67.0	3.5	2.0	38.31	37.69	0.54	0.46
M64	—	71.0	3.5	2.0	40.31	39.69	0.54	0.46
(M68)	—	75.0	3.5	2.0	43.31	42.69	0.54	0.46

[A)] A true radius is not essential providing that the curve is smooth and lies wholly within the maximum radius, determined from the maximum transitional diameter and the minimum radius specified.

10 Angularity and eccentricity of bolts, screws and nuts

10.1 The axis of the thread of the nut shall be square to the face of the nut subject to the "squareness tolerance" given in column 9 of Table 5, which is equivalent to an out of squareness of ±1°.

10.2 The nut shall be screwed by hand on to a gauge having a truncated taper thread until the thread of the nut is tight on the thread of the gauge. A sleeve sliding on a parallel extension of the gauge, and which has a face of diameter equal to the minimum distance across flats of the nut, and at exactly 90° to the axis of the gauge, shall be brought into contact with the leading face of the nut.

10.3 The sleeve shall be in such a position so that it is not possible for a feeler gauge of thickness equal to the squareness tolerance to enter anywhere between the leading face of the nut and face of the sleeve (see Annex B).

10.4 The hexagon flats of bolts, screws and nuts shall be square to the bearing face, and the angularity of the head shall be within the limits of 90° ±1° (see Annex E).

10.5 The eccentricity of the hexagon flats of nuts relative to the thread diameter shall not exceed the values given in Table 5, column 10.

10.6 The eccentricity of the head relative to the width across flats and eccentricity between the shank and thread of bolts and screws shall not exceed the values given in column 18 and 19, respectively, of Table 4b.

11 Dimensions of nuts

Figure 6 to Figure 8 show the symbols used in Table 5 for nut dimensions. Figure 9 to Figure 11 show the symbols used in Table 6.

Figure 6 **Normal thickness nut**

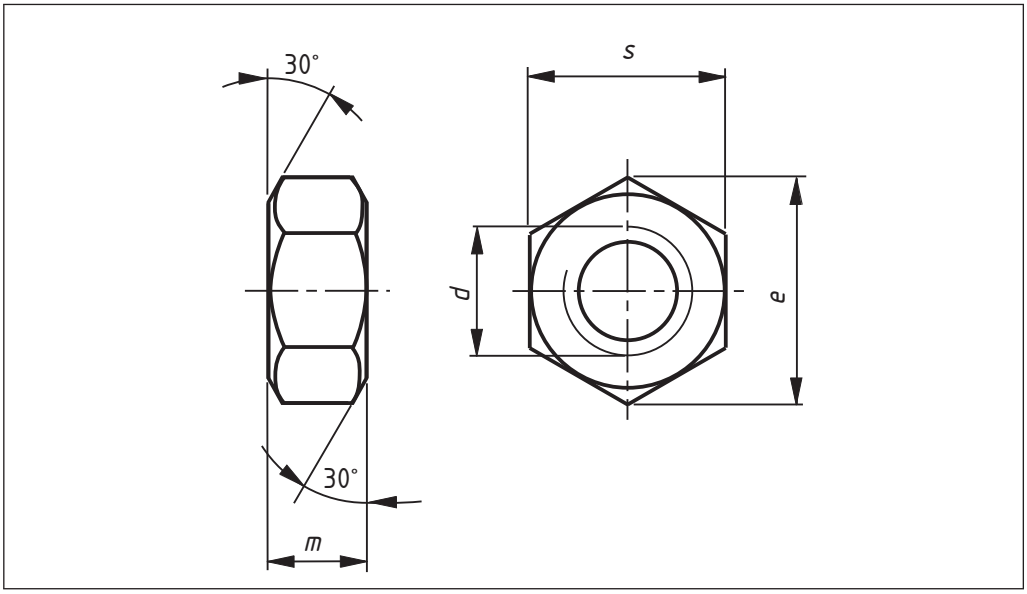


Figure 7 **Thin nut**

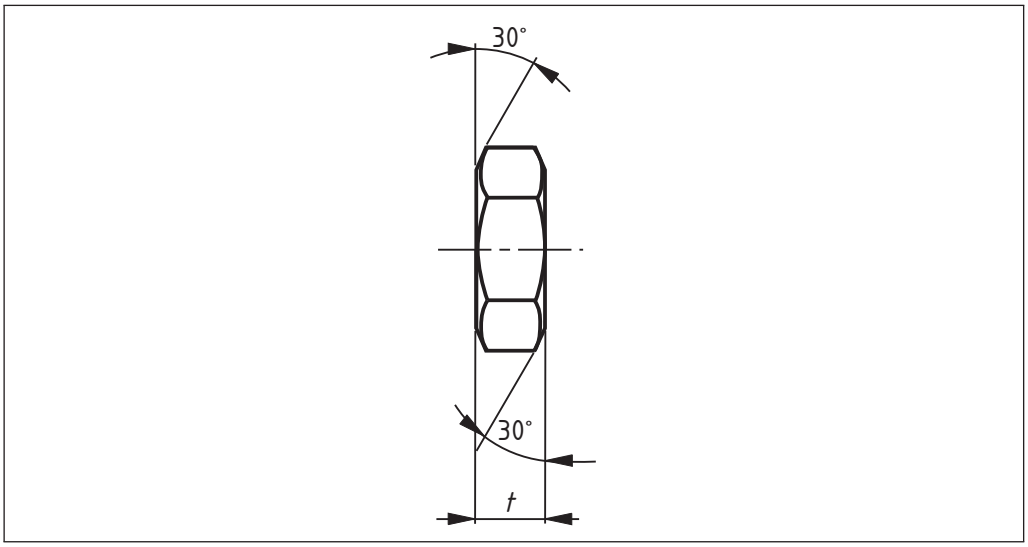


Figure 8 **Enlarged view of nut countersunk**

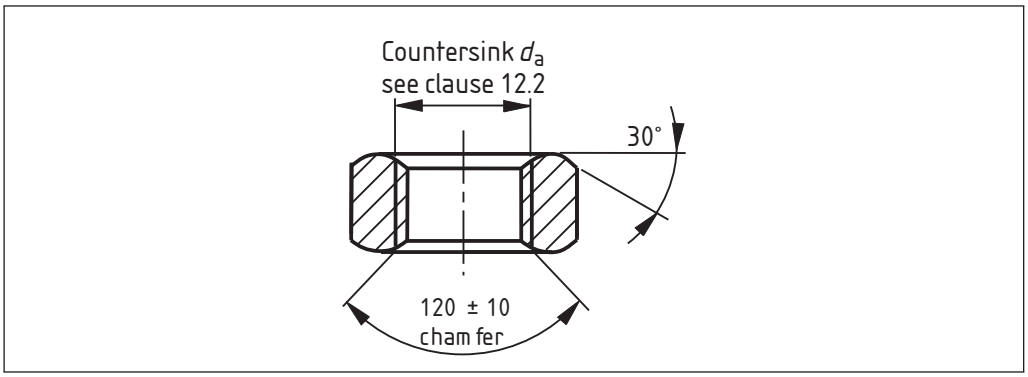


Table 5 **ISO metric precision hexagon nuts and thin nuts** *(1 of 2)*

Dimensions in millimetres

1	2	3	4	5	6	7	8	9	10	11	12
Nominal size and thread diameter ***d***	**Pitch of thread (coarse pitch series)**	**Width across flats** ***s***		**Width across corners** ***e***		**Thickness of normal nut** ***m***		**Tolerance on squareness of thread to face of nut**	**Eccentricity of hexagon**	**Thickness of thin nut** ***t***	
		max.	**min.**	**max.**	**min.**	**max.**	**min.**	**max.**	**max.**	**max.**	**min**
M1.6	0.35	3.20	3.08	3.70	3.48	1.30	1.05	0.05	0.14	—	—
M2	0.4	4.00	3.88	4.60	4.38	1.60	1.35	0.06	0.14	—	—
M.2	0.45	5.00	4.88	5.80	5.51	2.00	1.75	0.08	0.14	—	—
M3	0.5	5.50	5.38	6.40	6.08	2.40	2.15	0.09	0.14	—	—
M4	0.7	7.00	6.85	8.10	7.74	3.20	2.90	0.11	0.18	—	—
M5	0.8	8.00	7.85	9.20	8.87	4.00	3.70	0.13	0.18	—	—
M6	1	10.00	9.78	11.50	11.05	5.00	4.70	0.17	0.18	—	—
M8	1.25	13.00	12.73	15.00	14.38	6.50	6.14	0.22	0.22	5.0	4.70
M10	1.50	17.00	16.73	19.60	18.90	8.00	7.64	0.29	0.22	6.0	5.70
M12	1.75	19.00	18.67	21.90	21.10	10.00	9.64	0.32	0.27	7.0	6.64
(M14)	2	22.00	21.67	25.40	24.49	11.00	10.57	0.37	0.27	8.0	7.64
M16	2	24.00	23.67	27.70	26.75	13.00	12.57	0.41	0.27	8.0	7.64
(M18)	2.5	27.00	26.67	31.20	30.14	15.00	14.57	0.46	0.27	9.0	8.64
M20	2.5	30.00	29.67	34.60	33.53	16.00	15.57	0.51	0.33	9.0	8.64
(M22)	2.5	32.00	31.67	36.90	35.72	18.00	17.57	0.54	0.33	10.0	9.64
M24	3	36.00	35.38	41.60	39.98	19.00	18.48	0.61	0.33	10.0	9.64
(M27)	3	41.00	40.38	47.30	45.63	22.00	21.48	0.70	0.33	12.0	11.57
M30	3.5	46.00	45.38	53.10	51.28	24.00	23.48	0.78	0.33	12.0	11.57
(M33)	3.5	50.00	49.38	57.70	55.80	26.00	25.48	0.85	0.39	14.0	13.57
M36	4	55.00	54.26	63.50	61.31	29.00	28.48	0.94	0.39	14.0	13.57
(M39)	4	60.00	59.26	69.30	66.96	31.00	30.38	1.03	0.39	16.0	15.57
M42	4.5	65.00	64.26	75.10	72.61	34.00	33.38	1.11	0.39	16.0	15.57
(M45)	4.5	70.00	69.26	80.80	78.26	36.00	35.38	1.20	0.39	18.0	17.57
M48	5	75.00	74.26	86.60	83.91	38.00	37.38	1.29	0.39	18.0	17.57
(M52)	5	80.00	79.26	92.40	89.56	42.00	41.38	1.37	0.46	20.0	19.48

Table 5 **ISO metric precision hexagon nuts and thin nuts** *(2 of 2)*

Dimensions in millimetres

1	2	3	4	5	6	7	8	9	10	11	12
Nominal size and thread diameter ***d***	**Pitch of thread (coarse pitch series)**	**Width across flats** ***s***		**Width across corners** ***e***		**Thickness of normal nut** ***m***		**Tolerance on squareness of thread to face of nut**	**Eccentricity of hexagon**	**Thickness of thin nut** ***t***	
		max.	**min.**	**max.**	**min.**	**max.**	**min.**	**max.**	**max.**	**max.**	**min**
M56	5.5	85.00	84.13	98.10	95.07	45.00	44.38	1.46	0.46	—	—
(M60)	5.5	90.00	89.13	103.90	100.72	48.00	47.38	1.55	0.46	—	—
M64	6	95.00	94.13	109.70	106.37	51.00	50.26	1.63	0.46	—	—

NOTE 1 Sizes shown in brackets are non-preferred.

NOTE 2 For tolerances on squareness of thread to face of nut, see Annex B.

Figure 9 **Slotted nut. Sizes M4 to M39 only (six slots)**

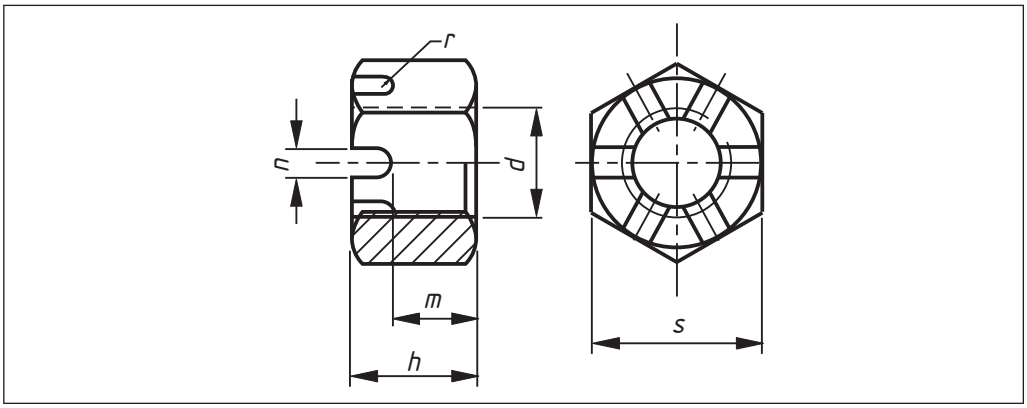


Figure 10 **Castle nut. Sizes M12 to M39 only (six slots)**

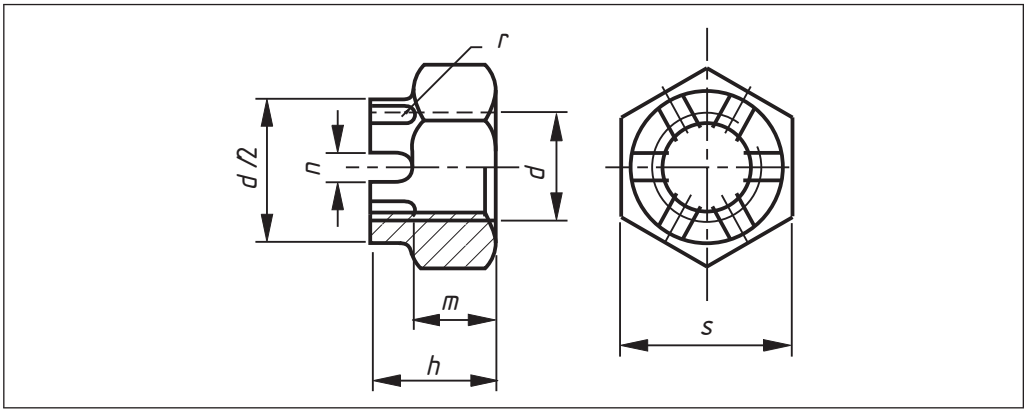


Figure 11 **Castle nut. Sizes M42 to M68 only (eight slots)**

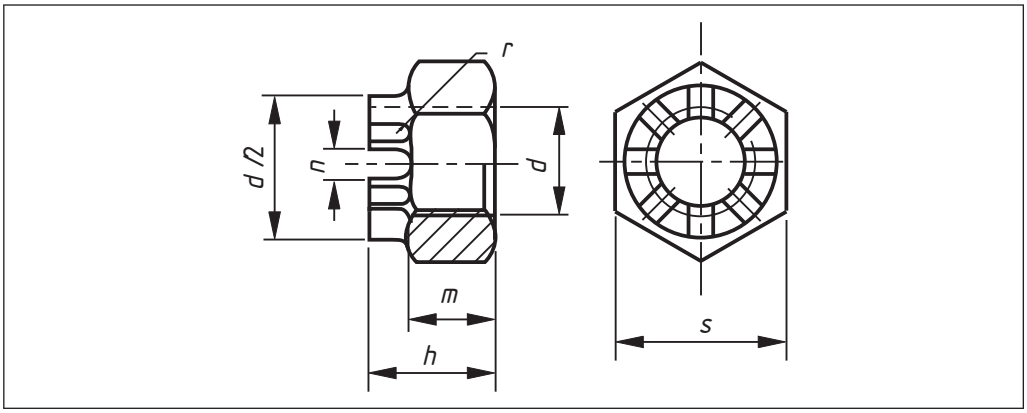


Table 6 – ISO metric precision hexagon slotted nuts and castle nuts

Dimensions in millimetres

Nominal size and thread diameter	Diameter d_2		Thickness h		Lower face of nut to bottom of slot m		Width of slot n		Radius (0.25n) r	Nominal size of split pin and nominal drill	Eccentricity of the slots max.
d	max.	min.	max.	min.	max.	min.	max.	min.	min.		
M4	—	—	5	4.70	3.2	2.90	1.45	1.2	0.3	It is intended to provide appropriate values in this column once International agreement has been reached on metric series split cotter pins	0.18
M5	—	—	6	5.70	4	3.70	1.65	1.4	0.35		0.18
M6	—	—	7.5	7.14	5	4.70	2.25	2	0.5		0.18
M8	—	—	9.5	9.14	6.5	6.14	2.75	2.5	0.625		0.22
M10	—	—	12	11.57	8	7.64	3.05	2.8	0.7		0.22
M12	17	16.57	15	14.57	10	9.64	3.80	3.5	0.875		0.27
(M14)	19	18.48	16	15.57	11	10.57	3.80	3.5	0.875		0.27
M16	22	21.48	19	18.48	13	12.57	4.80	4.5	1.125		0.27
(M18)	25	24.48	21	20.48	15	14.57	4.80	4.5	1.125		0.27
M20	28	27.48	22	21.48	16	15.57	4.80	4.5	1.125		0.33
(M22)	30	29.48	26	25.48	18	17.57	5.80	5.5	1.375		0.33
M24	34	33.38	27	26.48	19	18.48	5.80	5.5	1.375		0.33
(M27)	38	37.38	30	29.48	22	21.48	5.80	5.5	1.375		0.33
M30	42	41.38	33	32.38	24	23.48	7.36	7	1.75		0.33
(M33)	46	45.38	35	34.38	26	25.48	7.36	7	1.75		0.39
M36	50	49.38	38	37.38	29	28.48	7.36	7	1.75		0.39
(M39)	55	54.26	40	39.38	31	30.38	7.36	7	1.75		0.39
M42	58	57.26	46	45.38	34	33.38	9.36	9	2.25		0.39
(M45)	62	61.26	48	47.38	36	35.38	9.36	9	2.25		0.39
M48	65	64.26	50	49.38	38	37.38	9.36	9	2.25		0.39
(M52)	70	69.26	54	53.26	42	41.38	9.36	9	2.25		0.46
M56	75	74.26	57	56.26	45	44.38	9.36	9	2.25		0.46
(M60)	80	79.26	63	62.26	48	47.38	11.43	11	2.75		0.46
M64	85	84.13	66	65.26	51	50.26	11.43	11	2.75		0.46
M68	90	89.13	69	68.26	54	53.26	11.43	11	2.75		0.46

NOTE 1 For width across flats and widths across corners, see Table 5.

NOTE 2 Sizes shown in brackets are non-preferred.

12 Chamfering, washer facing and countersinking bolts, screws and nuts

12.1 Bolts and screws

Bolt and screw heads shall have a chamfer of approximately 30° on their upper faces and, at the option of the manufacturer, a washer face or full bearing face on the underside unless the purchaser in their enquiry or order specifically states that they require one of the alternatives available.

NOTE Attention is drawn to the fact that these alternative methods of finishing the underside of bolt and screw heads are associated with both the nominal size and the particular method of manufacture. A request by the purchaser for a specific type of finish limits the manufacturing processes available.

12.2 Nuts

12.2.1 Nuts shall have a chamfer of approximately 30° on both faces in accordance with Figure 8.

12.2.2 Nuts shall be countersunk at an included angle of 120° ±10° at both ends of the thread. The diameter of the countersink shall conform to the requirement of BS EN ISO 4759-1:2001, Figure 69 as follows:

$d \leq 5$ mm: $d_{a\ max} = 1.15d$

5 mm < $d \leq 8$ mm: $d_{a\ max} = d + 0.75$

$d > 8$ mm: $d_{a\ max} = 1.08d$

for all sizes: $d_{a\ min} = d$

NOTE Requirements are applicable to both sides of symmetrical parts.

13 Material and manufacture of steel bolts and screws

13.1 Method of production

At the discretion of the manufacturer, steel bolts and screws shall, be produced by cold forging, hot forging or by turning from bar.

13.2 Chemical composition

*COMMENTARY ON **13.2***

The chemical compositions of steels with respect to carbon, phosphorus, sulfur and boron is given in BS EN ISO 898-1:2013 [1)]*, Table 2, and the chemical compositions of steels given are for guidance only. The choice of steels, which conform to these specified limits, is at the discretion of the manufacturer.*

The steel used shall be such that the finished product possesses the mechanical properties appropriate to the strength grade quoted.

13.3 Heat treatment

Grades designated 8.8, 10.9, and 12.9 shall be heat-treated to give the mechanical properties given in BS EN ISO 898-1.

[1)] BS EN ISO 898-1:2013, *Mechanical properties of fasteners made of carbon steel and alloy steel.*

NOTE Other grades may be heat-treated if this is necessary to obtain the mechanical properties given in BS EN ISO 898-1.

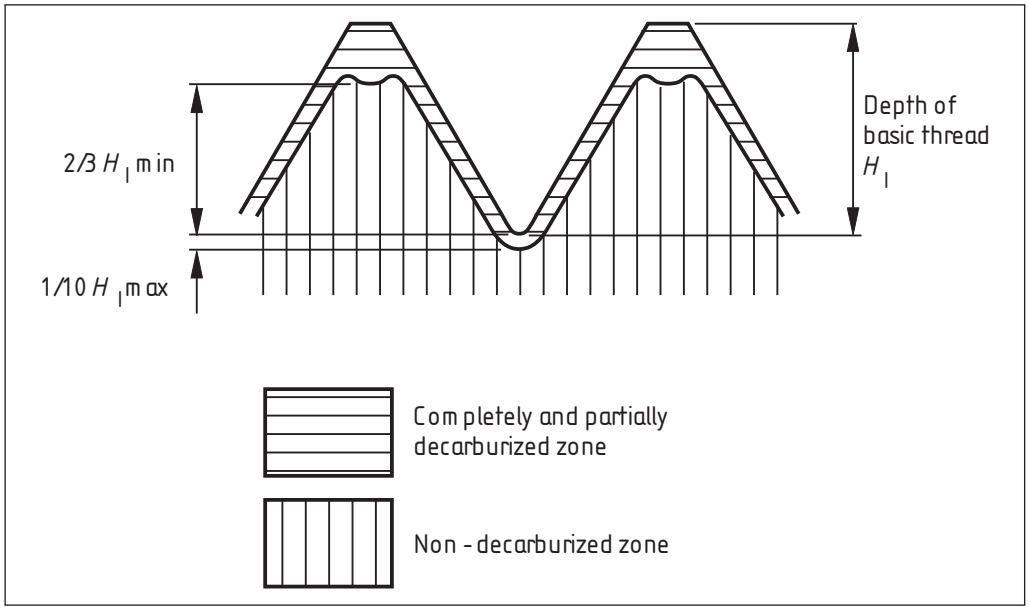
13.4 Decarburization

13.4.1 Decarburization of the thread surface shall not be greater than stipulated in **13.4.2** and **13.4.3** for bolts and screws of grade designations 8.8, 10.9, and 12.9.

13.4.2 The depth of the non-decarburized zone shall be not less than two thirds of the depth of the basic thread. In the root of the thread, the decarburization shall not exceed one tenth of the depth of the basic thread (see Figure 12).

13.4.3 The method of measuring the amount of decarburization shall be as specified in BS EN ISO 898-1.

Figure 12 **Depth of decarburization on steel bolts and screws**



13.5 Rolling laps

*COMMENTARY ON **13.5***

When threads are produced by rolling, small laps are commonly present at the crests and are generally of a magnitude which is not detrimental to the performance of the bolt.

13.5.1 A lap formed at the crest of the thread perpendicular to the axis of the bolt shall not be a cause for rejection if the depth of the lap does not exceed 33% of the depth of the thread.

13.5.2 Bolts of grades designated 10.9 and 12.9 shall be free from laps in the thread flank below the effective diameter. Laps in the flanks above the effective diameter shall not have a depth greater than 33% of the thread depth.

14 Mechanical properties of steel bolts and screws

Steel bolts and screws shall meet the requirements for mechanical properties given in BS EN ISO 898-1.

NOTE The strength grade designation system for bolts and screws is given in Annex A.

15 Strength grade designation system for steel nuts

The strength grade designation system for steel nuts shall be a number that is one hundredth of the specified proof load stress in MPa.

NOTE 1 The proof load stress corresponds to one hundredth of the nominal tensile strength of the highest grade of bolt, stud or screw with which the nut can be used (see Table 7).

*NOTE 2 The mechanical properties of steel nuts are given in Clause **17**. It is recommended that the grades of nut to be used with each grade of bolt or screw should be as shown in Table 8.*

Table 7 **Strength grade designation of steel nuts**

Strength grade designation	4	5	6	8	10	12
Proof load stress MPa	400	500	600	800	1 000	1 200

Table 8 **Recommended bolt and nut combinations**

Grade of bolt	4.6	4.8	5.6	5.8	6.8	8.8	8.8 [A)]	10.9	10.9 [A)]	12.9
Recommended grade of nut	4	4	5	5	6	8	10	10	12	12

[A)] When a thick protective coating is applied to a bolt of grade 8.8 or 10.9 which requires the nut thread to be overtapped, the next higher grade of nut should be used.

NOTE 1 The nuts in Table 7 are at least 15% lower in height than ISO metric 'Regular' nuts, in BS EN ISO 4032 for example. Therefore they are not capable of withstanding the same tensile loads without the risk of thread stripping (see also Foreword).

NOTE 2 Nuts of a higher strength grade may be substituted for nuts of a lower strength grade.

16 Material and manufacture of steel nuts

16.1 Method of manufacture

Steel nuts shall be produced by cold forging, hot forging or by turning from bar. The choice of manufacture is at the option of the manufacturer.

16.2 Chemical composition

The chemical composition of materials from which steel nuts shall be made are given in Table 9.

NOTE The use of free-cutting steels at temperatures above 250°C is not recommended. Free-cutting steel may be used where permitted in Table 9, or otherwise by special agreement between the purchaser and the supplier.

Table 9 **Chemical composition of steel nuts**

Strength grade designation	Chemical composition limits (check analysis)			
	Carbon max. %	Manganese min. %	Phosphorus max. %	Sulfur max. %
4, 5 and 6 (See notes)	0.50	—	0.110	0.150
8	0.58	0.30	0.060	0.150
10 and 12 (See notes)	0.58	0.45	0.048	0.058

NOTE 1 Free cutting steel may be used only by special agreement between the purchaser and the supplier. In such cases, the following maximum phosphorus, sulfur and lead contents are permissible:

Phosphorus, 0.12%; Sulfur, 0.34%; Lead, 0.35%.

*NOTE 2 Alloying elements may be added if necessary to develop the mechanical properties of the nuts stipulated in Clause **17**.*

16.3 Heat treatment

Nuts shall be heat-treated where this is necessary to obtain the mechanical properties given in Clause **17**.

17 Mechanical properties of steel nuts (excluding thin nuts)

Steel nuts (excluding thin nuts) shall meet the requirements for mechanical properties given in Table 10. The nuts shall withstand the proof load stress given in Table 10 when tested in accordance with Annex C. Nuts that are proof load tested shall have a hardness not in excess of the maximum given in Table 10. Nuts which are not proof load tested shall have a hardness not less than the minimum agreed between the purchase and the supplier and not more than the maximum given in Table 10. The tests shall be in accordance with Annex C.

Table 10 **Mechanical properties of steel nuts**

Strength grade designation	4	5	6	8	10	12	
Proof load stress [A] MPa	400	500	600	800	1 000	1 200	— [C]
Brinell hardness (HB) max.	302	302	302	302	353	375	All nuts
Rockwell hardness [B] (HRC) max.	30	30	30	30	36	39	All nuts
Vickers hardness (HV) max.	310	310	310	310	370	395	All nuts

NOTE For materials and mechanical properties of hexagon bolts and screws, refer to BS EN ISO 898-1.

[A] The proof load is calculated by multiplying the proof load stress by the tensile stress area of the bolt.

[B] The conversion from Brinell hardness into Rockwell hardness has been calculated in accordance with BS EN ISO 6506-1 BS EN ISO 6506-2 and BS EN ISO 6506-3, and BS EN ISO 6508-1.

[C] All nuts other than those exempted by agreement between the purchaser and the manufacturer. Nuts with a specified proof load in excess of 500 000 N (see Table 11) may be except from proof load testing. Such nuts shall meet the minimum hardness as agreed between the purchaser and the manufacturer.

Table 11 **Proof loads for steel nuts (coarse pitch series)** *(1 of 2)*

Nominal size of nut mm	Tensile stress area of bolt mm^2	Strength grade designation					
		4	5	6	8	10	12
		Stress under proof load MPa					
		400	500	600	800	1 000	1 200
		Proof load N					
M1.6	1.27	510	640	760	1 020	1 270	1 520
M2	2.07	830	1 030	1 240	1 650	2 070	2 480
M2.5	3.39	1 360	1 700	2 030	2 710	3 390	4 070
M3	5.03	2 010	2 520	3 020	4 000	5 000	6 000
M4	8.78	3 510	4 400	5 250	7 000	8 750	10 500
M5	14.2	5 680	7 100	8 500	11 400	14 200	17 000
M6	20.1	8 040	10 000	12 000	16 000	20 000	24 000
M8	36.6	14 600	18 300	22 000	29 000	36 500	43 000
M10	58.0	23 200	29 000	35 000	46 000	58 000	69 500
M12	84.3	33 700	42 100	50 500	67 000	84 000	100 000
M14	115	46 000	57 500	69 000	92 000	115 000	138 000
M16	157	62 800	78 500	94 000	125 000	157 000	188 000
M18	192	76 800	98 000	115 000	154 000	192 000	230 000
M20	245	98 000	122 000	147 000	196 000	245 000	294 000
M22	303	121 000	151 000	182 000	242 000	303 000	364 000
M24	353	141 000	175 000	212 000	282 000	353 000	423 000
M27	459	184 000	230 000	276 000	367 000	459 000	550 000
M30	561	224 000	280 000	336 000	448 000	561 000	673 000
M33	694	278 000	347 000	416 000	555 000	694 000	833 000
M36	817	327 000	408 000	490 000	653 000	817 000	980 000
M39	976	390 000	488 000	585 000	780 000	976 000	1 170 000
M42	1 120	448 000	560 000	672 000	896 000	1 120 000	1 340 000
M45	1 300	520 000	650 000	780 000	1 040 000	1 300 000	1 560 000
M48	1 470	588 000	735 000	882 000	1 180 000	1 470 000	1 760 000
M52	1 760	704 000	880 000	1 060 000	1 410 000	1 760 000	2 110 000

Table 11 **Proof loads for steel nuts (coarse pitch series)** *(2 of 2)*

Nominal size of nut	**Tensile stress area of bolt**	**Strength grade designation**					
		4	**5**	**6**	**8**	**10**	**12**
mm	**mm²**	**Stress under proof load**					
		MPa					
		400	**500**	**600**	**800**	**1 000**	**1 200**
		Proof load					
		N					
M56	2 030	812 000	1 015 000	1 220 000	1 620 000	2 030 000	2 440 000
M60	2 360	944 000	1 180 000	1 420 000	1 890 000	2 360 000	2 830 000
M64	2 680	1 072 000	1 340 000	1 610 000	2 140 000	2 680 000	3 220 000
M68	3 060	1 224 000	1 530 000	1 840 000	2 450 000	3 060 000	3 670 000

NOTE 1 Proof load = Stress under proof × tensile stress area of bolt

NOTE 2 For stress under proof load, see Table 10.

*NOTE 3 Nuts with a specified proof load above 500 000 N force may be exempted from proof load testing, see Clause **17** and Table 10.*

18 Drilled bolts with split pin holes

18.1 Bolts with split pin holes are supplied only when specially ordered. The purchaser usually states, in the enquiry and order, dimension l_p, as illustrated in Figure 3.

18.2 A tolerance of –0 / +0.8 mm shall be permissible on the specified dimension l_p.

18.3 The split pin holes shall be drilled through the centre of the bolt as specified in BS EN ISO 1234.

19 Finishes

Steel precision bolts, screws and nuts shall be supplied with one of finishes given in Table 12.

Table 12 **Finishes**

Product type	Finishes
Heat-treated bolts and screws	Components heat-treated after manufacture shall be dull black, although the manufacturer might machine some of the surfaces of the larger size bolts and screws after heat treatment.
Bright finished bolts and screws	This term is used to describe bolts and screws which are finished bright on all surfaces or which have a finish on the hexagon, produced by bright drawing.
Nuts	These can be bright on all surfaces or dull black when heat-treated.
Other finishes	If the purchaser requires bolts, screws or nuts (or other material) to be coated, the type of coating required should be stated in their enquiry and order, where reference should be made to the appropriate British Standard, i.e. BS EN ISO 4042, BS 7371-6 or BS EN ISO 10684.

NOTE If steel bolts, screws or nuts are required finished bright all over, this is usually stated in the enquiry and order.

20 Marking and identification

*COMMENTARY ON CLAUSE **20***

The marking and identification requirements of this British Standard are applicable to steel bolts, screws and nuts of 6 mm diameter and larger; manufactured to strength grade designations 8.8 (for bolts or screws) and 8 (for nuts) or higher.

20.1 Bolts and screws

Marking of bolts and screws shall be in accordance with BS EN ISO 898-1:2013, Clause **10**.

20.2 Nuts

Nuts shall be marked with the strength grade designation between two vertical bars as shown in Table 13.

Table 13 **Marking of nuts**

Strength grade designation	8	10	12
Marking symbol	|8|	|10|	|12|

21 Inspection and testing

Tests for mechanical properties shall be in accordance with BS EN ISO 898-1 for bolts and screws and Annex C for nuts.

Annex A (informative) Strength grade designation system for steel bolts and screws

Being in accordance with BS EN ISO 898-1, the strength grade designation system (property class symbol) for steel bolts and screws consists of two numbers separated by a dot (see Table A.1). The number to the left of the dot is one hundredth of the nominal tensile strength in MPa, and the number to the right is 10 times the ratio between the nominal yield strength (or nominal stress at permanent set limit, R0.2 nom) and the nominal tensile strength.

Table A.1 — Strength grade designations of steel bolts and screws

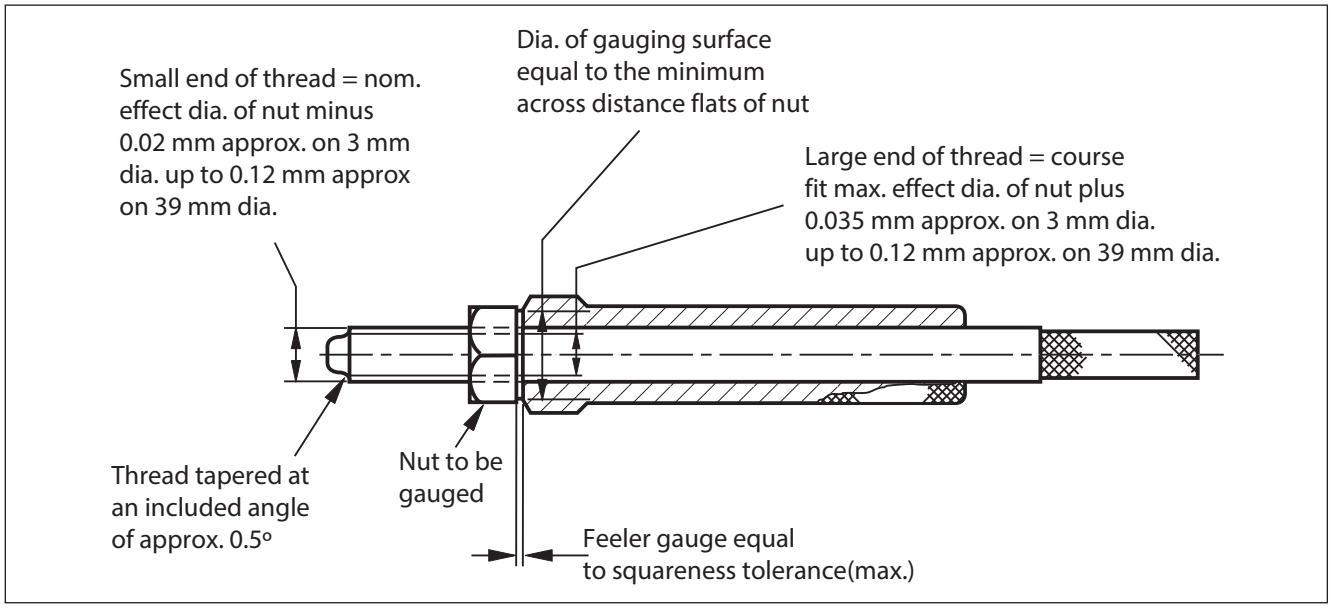
Strength grade designation	4.6	4.8	5.6	5.8	6.8	8.8	10.9	12.9
Tensile strength Rm nominal. MPa	400	400	500	500	600	800	1 000	1 200
Yield stress Re nominal. MPa	240	320	300	400	480	—	—	—
Stress at permanent set limit R0.2 MPa	—	—	—	—	—	640	900	1 080

NOTE Refer to BS EN ISO 898-1 for full details of the range of mechanical property requirements for these strength grades.

Annex B (informative) Recommended gauge for checking squareness of thread to face of nut

Figure B.1 shows the recommended gauge for checking the squareness of the thread to the face of the nut.

Figure B.1 **Nut squareness gauge**



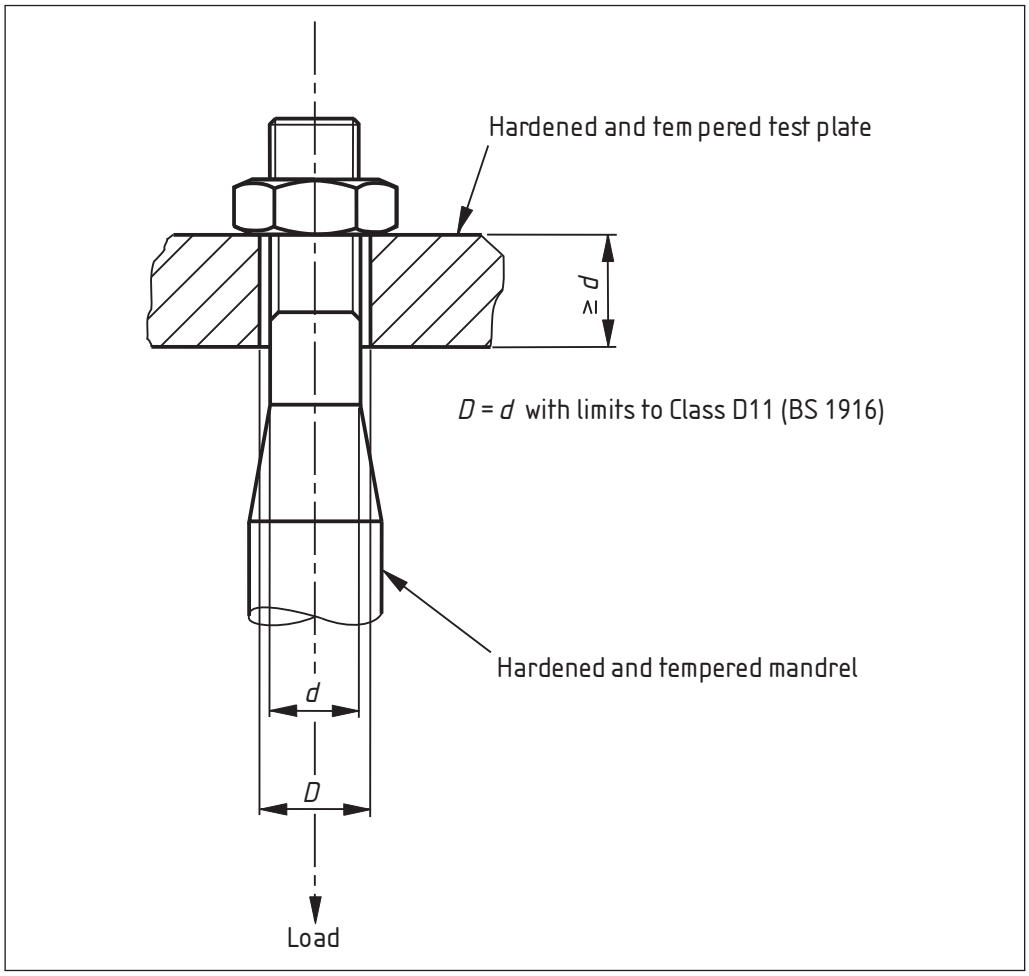
Annex C (normative) Testing of mechanical properties of steel nuts

C.1 Proof load test

C.1.1 The proof load test consists of applying the relevant proof load given in Table 11 which was obtained from the proof load stress given in Table 10.

C.1.2 Assemble the nut to be tested on a hardened and tempered mandrel as shown in Figure C.1 and apply the specified load in an axial direction.

Figure C.1 **Proof load test for nut**



C.1.3 The nut shall withstand this load without failure by stripping or rupture, and shall be removable by hand after the load is released. If the threads of the mandrel are damaged during the test, the test shall be discarded.

NOTE It might be necessary to use a manual wrench to start the nut in motion. Such wrenching is permissible providing it is restricted to a half turn and the nut is then removable by hand after this initial loosening.

C.2 Hardened mandrel

The mandrel shall have a hardness of not less than Rockwell C45. The thread shall be tolerance class 5*h* except that the tolerance on the major diameter shall be the last quarter of the 6*g* range of the minimum material side.

C.3 Hardened test plate

The test plate shall have a hardness of not less than Rockwell C38.

C.4 Hardness test on nuts

C.4.1 Brinell, Rockwell and Vickers hardness may be determined. Apply the impression to the top and bottom face of the nut, otherwise on the side of the nut.

C.4.2 Perform a Brinell hardness test in accordance with BS EN ISO 6506-1, BS EN ISO 6506-2, BS EN ISO 6506-3 and BS EN ISO 6506-4.

C.4.3 Perform a Rockwell hardness test in accordance with BS EN ISO 6508-1, BS EN ISO 6508-2 and BS EN ISO 6508-3.

C.4.4 Perform a Vickers hardness test in accordance with of BS EN ISO 6507-1, BS EN ISO 6507-2, BS EN ISO 6507-3 and BS EN ISO 6507-4.

Annex D (informative) Association of bolt and screw lengths and diameters (see Clause 8)

D.1 Table D.1a and Table D.1b give the preferred standard size of ISO metric precision hexagon bolts and screws.

Table D.1a **Preferred standard sizes of ISO metric precision hexagon bolts and screws** *(1 of 2)*

Nominal size and thread diameter *d*	Standard nominal lengths *l* — Dimensions in millimetres																									
	5	6	(7)	8	(9)	10	(11)	12	14	16	(18)	20	(22)	25	(28)	30	(32)	35	(38)	40	45	50	55	60	65	70	75
M1.6	X	X	O	X	O	X	O	X	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
M2	X	X	O	X	O	X	O	X	X	X	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—
M2.5	X	X	O	X	O	X	O	X	X	X	O	X	O	X	—	—	—	—	—	—	—	—	—	—		—	—
M3	X	X	O	X	O	X	O	X	X	X	O	X	O	X	O	X	O	X	O	X	X	X	—	—		—	—
M4	X	X	O	X	O	X	O	X	X	X	O	X	O	X	O	X	O	X	O	X	X	X	—	X	X	X	—
M5	—	X	O	X	O	X	O	X	X	X	O	X	O	X	O	X	O	X	O	X	X	X	X	X	X	X	X
M6	—	X	O	X	O	X	O	X	X	X	O	X	O	X	O	X	O	X	O	X	X	X	X	X	X	X	X
M8	—	—	—	X	O	X	O	X	X	X	O	X	O	X	O	X	O	X	O	X	X	X	X	X	X	X	X
M10	—	—	—	X	O	X	O	X	X	X	O	X	O	X	O	X	O	X	O	X	X	X	X	X	X	X	X
M12	—	—	—	—	—	X	O	X	X	X	O	X	O	X	O	X	O	X	O	X	X	X	X	X	X	X	X
(M14)	—	—	—	—	—	X	O	X	X	X	O	X	O	X	O	X	O	X	O	X	X	X	X	X	X	X	X
M16	—	—	—	—	—	—	—	X	X	X	O	X	O	X	O	X	O	X	O	X	X	X	X	X	X	X	X
(M18)	—	—	—	—	—	—	—	—	—	X	O	X	O	X	O	X	O	X	O	X	X	X	X	X	X	X	X
M20	—	—	—	—	—	—	—	—	—	X	O	X	O	X	O	X	O	X	O	X	X	X	X	X	X	X	X
(M22)	—	—	—	—	—	—	—	—	—	X	O	X	O	X	O	X	O	X	O	X	X	X	X	X	X	X	X
M24	—	—	—	—	—	—	—	—	—	X	O	X	O	X	O	X	O	X	O	X	X	X	X	X	X	X	X
(M27)	—	—	—	—	—	—	—	—	—	X	O	X	O	X	O	X	O	X	O	X	X	X	X	X	X	X	X
M30	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	X	O	X	X	X	X	X	X	X	X
(M33)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	X	O	X	X	X	X	X	X	X	X
M36	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	X	O	X	X	X	X	X	X	X	X
(M39)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	X	O	X	X	X	X	X	X	X	X
M42	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	X	X	X	X	X	X	X	X
(M45)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	X	X	X	X	X	X	X	X
M48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	X	X	X	X	X	X	X	X
(M52)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	X	X	X	X	X	X
M56	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
(M60)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
M64	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
(M68)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Table D.1a **Preferred standard sizes of ISO metric precision hexagon bolts and screws** *(2 of 2)*

Nominal size and thread diameter *d*	**Standard nominal lengths *l***																									
	5	**6**	**(7)**	**8**	**(9)**	**10**	**(11)**	**12**	**14**	**16**	**(18)**	**20**	**(22)**	**25**	**(28)**	**30**	**(32)**	**35**	**(38)**	**40**	**45**	**50**	**55**	**60**	**65**	**70**	**75**

Dimensions in millimetres

NOTE 1 Bolded symbols screws only.

NOTE 2 Sizes and lengths shown in brackets are non-preferred.

NOTE 3 "x" indicates first choice length.

Table D.1b **Preferred standard sizes of ISO metric precision hexagon bolts and screws** *(1 of 2)*

Nominal size and thread diameter *d*	Standard nominal lengths, *l*																										
	80	85	90	(95)	100	(105)	110	(115)	120	(125)	130	140	150	160	170	180	190	200	220	240	260	280	300	325	350	375	400
M1.6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
M2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
M2.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
M3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
M4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
M5	X	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
M6	X	X	X	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
M8	X	X	X	O	X	O	X	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
M10	X	X	X	O	X	O	X	O	X	O	X	X	X	X	—	—	—	—	—	—	—	—	—	—	—	—	—
M12	X	X	X	O	X	O	X	O	X	O	X	X	X	X	X	X	—	—	—	—	—	—	—	—	—	—	—
(M14)	X	X	X	O	X	O	X	O	X	O	X	X	X	X	X	X	X	X	—	—	—	—	—	—	—	—	—
M16	X	X	X	O	X	O	X	O	X	O	X	X	X	X	X	X	X	X	X	—	—	—	—	—	—	—	—
(M18)	X	X	X	O	X	O	X	O	X	O	X	X	X	X	X	X	X	X	X	—	—	—	—	—	—	—	—
M20	X	X	X	O	X	O	X	O	X	O	X	X	X	X	X	X	X	X	X	—	—	—	—	—	—	—	—
(M22)	X	X	X	O	X	O	X	O	X	O	X	X	X	X	X	X	X	X	X	—	—	—	—	—	—	—	—
M24	X	X	X	O	X	O	X	O	X	O	X	X	X	X	X	X	X	X	X	—	—	—	—	—	—	—	—
(M27)	X	X	X	O	X	O	X	O	X	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
M30	X	X	X	O	X	O	X	O	X	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
(M33)	X	X	X	O	X	O	X	O	X	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
M36)	X	X	X	O	X	O	X	O	X	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
(M39)	X	X	X	O	X	O	X	O	X	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
M42	X	X	X	O	X	O	X	O	X	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
M45)	X	X	X	O	X	O	X	O	X	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
M48	X	X	X	O	X	O	X	O	X	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
(M52)	X	X	X	O	X	O	X	O	X	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
M56	—	—	—	—	—	—	X	O	X	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
(M60)	—	—	—	—	—	—	X	O	X	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
M64	—	—	—	—	—	—	X	O	X	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
(M68)	—	—	—	—	—	—	—	—	—	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table D.1b **Preferred standard sizes of ISO metric precision hexagon bolts and screws** *(2 of 2)*

Nominal size and thread diameter *d*	**Standard nominal lengths, *l***																										
	80	**85**	**90**	**(95)**	**100**	**(105)**	**110**	**(115)**	**120**	**(125)**	**130**	**140**	**150**	**160**	**170**	**180**	**190**	**200**	**220**	**240**	**260**	**280**	**300**	**325**	**350**	**375**	**400**

NOTE 1 *Bolded symbols screws only*

NOTE 2 *Sizes and lengths shown in brackets are non-preferred.*

NOTE 3 *"x" indicates first choice length.*

D.2 Table D.2 gives standard thread lengths and the shortest lengths designated as bolts, related to diameter.

Table D.2 **Standard thread lengths and the shortest lengths designated as bolts, related to diameter**

Dimensions in millimetres

Nominal size and bolt diameter	Length of thread b for nominal bolt length *l*			Tolerance on bolt thread length	Shortest length designated as a bolt
	Up to 125 mm	Over 125 mm and up to 200 mm	Above 200 mm		
d				*b*	
M1.6	9	—	—	+0.7	(11)
M2	10	—	—	+0.8	12
M2.5	11	—	—	+0.9	14
M3	12	—	—	+1.0	14
M4	14	—	—	+1.4	18
M5	16	—	—	+1.6	20
M6	18	—	—	+2.0	(22)
M8	22	—	—	+2.5	(28)
M10	26	32	—	+3.0	(32)
M12	30	36	—	+3.5	(38)
(M14)	34	40	—	+4.0	45
M16	38	44	57	+4.0	45
(M18)	42	48	61	+5.0	50
M20	46	52	65	+5.0	55
(M22)	50	56	69	+5.0	60
M24	54	60	73	+6.0	65
(M27)	60	66	79	+6.0	70
M30	66	72	85	+7.0	80
(M33)	72	78	91	+7.0	85
M36	78	84	97	+8.0	90
(M39)	84	90	103	+8.0	100
M42	90	96	109	+9.0	(105)
(M45)	96	102	115	+9.0	110
M48	102	108	121	+10.0	120
(M52)	—	116	129	+10.0	(125)
M56	—	124	137	+11.0	140
(M60)	—	132	145	+11.0	150
M64	—	140	153	+12.0	160
(M68)	—	148	161	+12.0	170

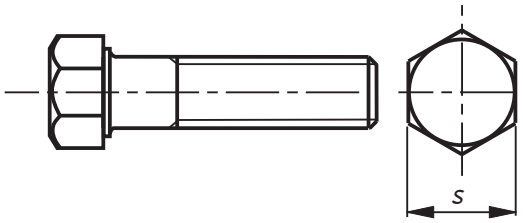
NOTE Sizes shown in brackets are non-preferred.

Annex E (informative) Basis for the derivation of tolerances

E.1 Hexagon bolts and screws

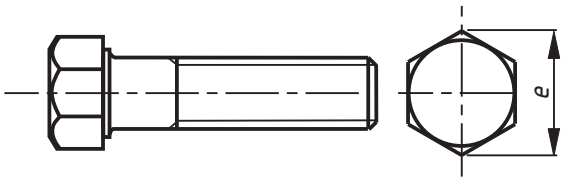
The following figures (Figure E.1 to Figure E.10 inclusive) illustrate the basis for the derivation of tolerances for hexagon bolts and screws.

Figure E.1 **Widths across flats**



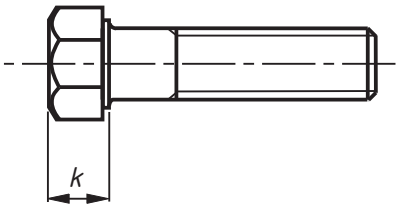
S mm	**Tolerance field for the width across flats *s***
≤ 8 mm	*h* 12
>8 ≤ 32 mm	*h* 13
>32 mm	*h* 14

Figure E.2 **Widths across corners**



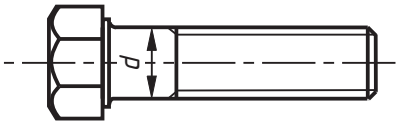
e_{min} = 1.13 × s_{min} for all products in accordance with BS EN ISO 4759-1.

Figure E.3 **Heights of heads**



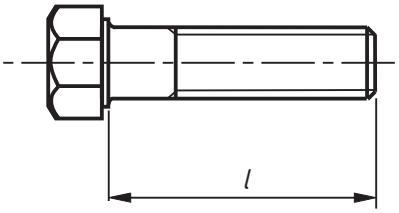
The tolerance field for the height of head (*k) js*14.

Figure E.4 **Shank diameter of full size bolts**



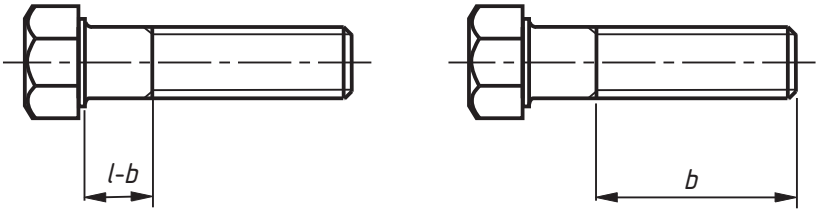
The tolerance field for the shank diameter (*d*) *h*13.

Figure E.5 **Nominal length**



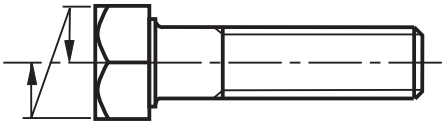
The tolerance field for the nominal length (l) ± ½ IT15.

Figure E.6 **Thread lengths**



The tolerance on dimensions $b\ ^{+2p}_{0}$, where p is the pitch of the thread.

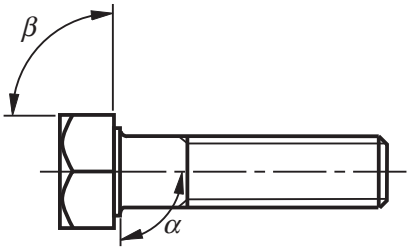
Figure E.7 **Eccentricity of the head**



The tolerance field for eccentricity of the head IT13.

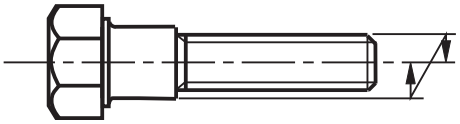
The reference dimension for the eccentricity is the width across flats.

Figure E.8 **Angularity of the head**



Angle α 90 ± 1°; angle β 90° ± 1°

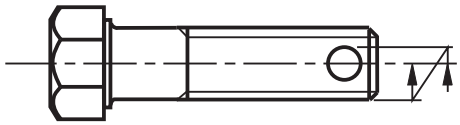
Figure E.9 **Eccentricity between shank and thread**



The tolerance field for eccentricity between shank and thread IT13.

The reference dimension for the eccentricity is the thread diameter.

Figure E.10 **Eccentricity of split pin hole**



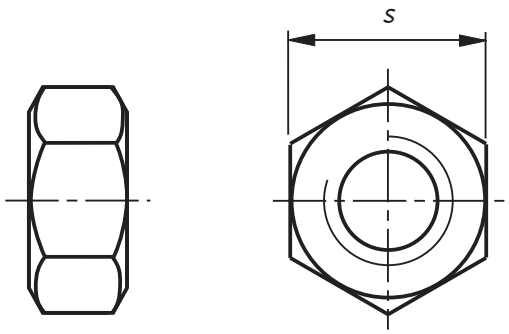
The tolerance field for eccentricity of split pin hole IT13.

The reference dimension for the eccentricity is the thread diameter.

E.2 Hexagon nuts

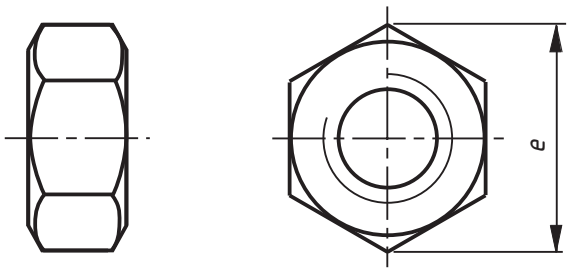
Figure E.11 to Figure E.17 illustrate the basis for the derivation of tolerances for hexagon nuts.

Figure E.11 **Widths across flats**



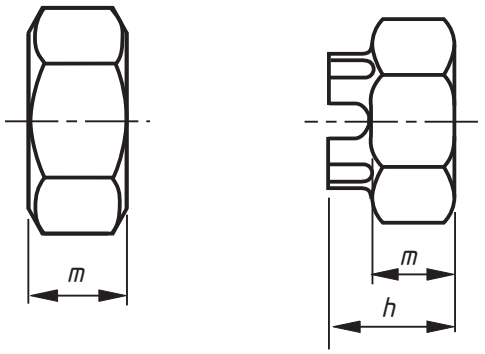
S	**Tolerance field for the width across flats *s***
≤ 8 mm	*h* 12
>8 ≤ 32 mm	*h* 13
>32 mm	*h* 14

Figure E.12 **Widths across corners**



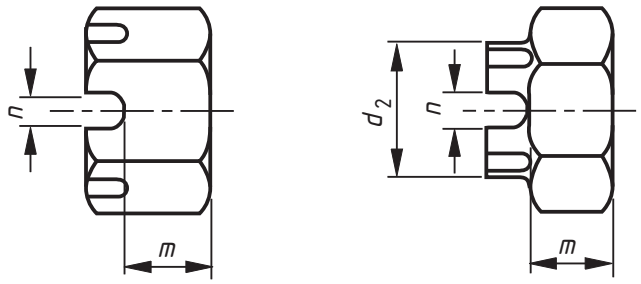
e_{min} = 1.13 × s_{min}. for all products in accordance with BS EN ISO 4759-1.

Figure E.13 **Thicknesses of nuts**



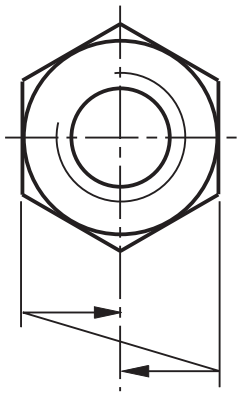
The tolerance field for the thicknesses of the nut *h* and *m*, *h*14.

Figure E.14 **Dimensions of slots**



Dimension	**Width of slot, *n***	**Depth of slot, *m***	**Diameter, d_2**
Tolerance field	*H*14	*h*14	*h*14

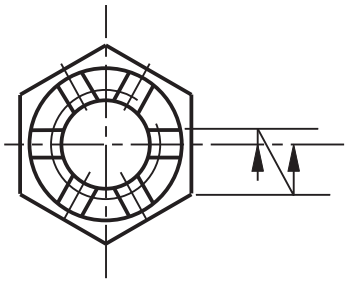
Figure E.15 **Eccentricity of the hexagon**



The tolerance field for eccentricity of the hexagon IT13.

NOTE The reference dimension for the eccentricity is the thread diameter.

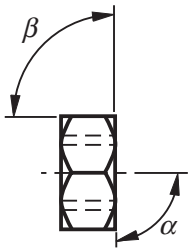
Figure E.16 **Eccentricity of the slots**



The eccentricity of the slots IT13.

NOTE The reference dimension for the eccentricity is the thread diameter.

Figure E.17 **Angularity of the nuts**



Angle α 90 ± 1°; angle β 90° ± 1°.

NOTE The reference dimension for the eccentricity is the thread diameter.

Annex F (informative)

Manufacturer's recommended range of sizes

The recommended range of sizes is shown in Table F.1 and Table F.2.

NOTE Depending on popular demand, the sizes stated in Table F.1 and Table F.2 might be revised. It is advisable to consult the supplier about current stock production sizes.

Table F.1 **Hexagon head bolts**

Nominal length	Nominal diameter							
mm	M5	M6	M8	M10	M12	M16	M20	M24
25	•	•	—	—	—	—	—	—
30	•	•	•	—	—	—	—	—
35	•	•	•	•	—	—	—	—
40	•	•	•	•	•	—	—	—
45	•	•	•	•	•	•	—	—
50	•	•	•	•	•	•	—	—
55	—	•	•	•	•	•	•	—
60	—	•	•	•	•	•	•	—
65	—	•	•	•	•	•	•	•
70	—	•	•	•	•	•	•	•
75	—	•	•	•	•	•	•	•
80	—	—	•	•	•	•	•	•
90	—	—	•	•	•	•	•	•
100	—	—	•	•	•	•	•	•
110	—	—	—	•	•	•	•	•
120	—	—	—	•	•	•	•	•
130	—	—	—	—	•	•	•	•
140	—	—	—	—	—	•	•	•
150	—	—	—	—	—	•	•	•
160	—	—	—	—	—	•	•	•

• Standard thread lengths

Table F.2 **Hexagon head screws**

Nominal length	Nominal diameter							
mm	M5	M6	M8	M10	M12	M16	M20	M24
10	•	—	—	—	—	—	—	—
12	•	•	—	—	—	—	—	—
16	•	•	•	—	—	—	—	—
20	•	•	•	•	—	—	—	—
25	•	•	•	•	•	—	—	—
30	•	•	•	•	•	•	—	—
35	—	•	•	•	•	•	—	—
40	—	•	•	•	•	•	•	—
45	—	—	•	•	•	•	•	—
50	—	•	•	•	•	•	•	•
55	—	—	—	•	•	•	•	—
60	—	—	•	•	•	•	•	•
70	—	—	—	•	•	•	•	—
80	—	—	—	•	•	•	•	—

• Standard thread lengths

Bibliography

Standards publications

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 7371-6, *Coatings on metal fasteners – Part 6: Specification for hot dipped galvanized coatings*

BS EN ISO 898-2, *Mechanical properties of fasteners made of carbon and alloy steel – Part 2: Nuts with specified property classes – Coarse thread and fine pitch thread*

BS EN ISO 4032, *Hexagon regular nuts (style 1) – Product grades A and B*

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