
International Standard



4016

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Hexagon head bolts — Product grade C

Boulons à tête hexagonale — Classe de produit C

First edition — 1979-06-15

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 4016 was developed by Technical Committee ISO/TC 2, *Fasteners*, and was circulated to the member bodies in December 1977.

It has been approved by the member bodies of the following countries:

Australia	India	Romania 1979
Belgium	Ireland	South Africa, Rep. of
Canada	Israel	Spain
Chile	Italy	Sweden
Czechoslovakia	Korea, Rep. of	Switzerland
Denmark	Mexico	Turkey
Egypt, Arab Rep. of	Netherlands	United Kingdom
Finland	New Zealand	USA
Germany, F.R.	Norway	Yugoslavia
Hungary	Poland	

The member bodies of the following countries expressed disapproval of the document on technical grounds:

France
USSR

Hexagon head bolts — Product grade C

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0 INTRODUCTION

This International Standard is part of the complete ISO product standards series on hexagon drive fasteners. The series comprises :

- a) Hexagon head bolts (ISO 4014, ISO 4015 and ISO 4016)
- b) Hexagon head screws (ISO 4017 and ISO 4018)
- c) Hexagon nuts (ISO 4032, ISO 4033, ISO 4034, ISO 4035 and ISO 4036)
- d) Hexagon flanged bolts
- e) Hexagon flanged screws
- f) Hexagon flanged nuts
- g) Structural bolting

(In preparation)

1 SCOPE AND FIELD OF APPLICATION

This International Standard gives specifications for hexagon head bolts with metric dimensions and thread diameters from 5 up to and including 36 mm, of product grade C.

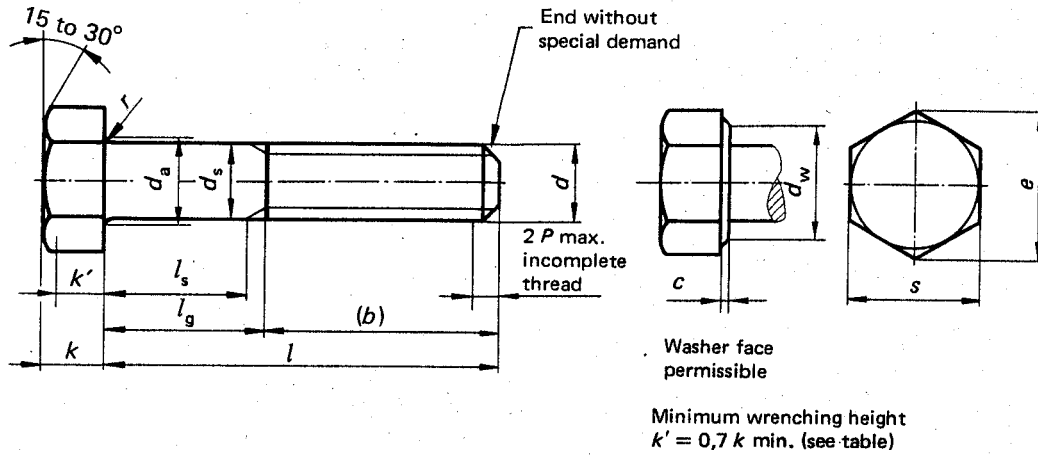
No finish is required for this product except for the thread. A small die seam across the bearing surface is permissible.

If in special cases, specifications other than those listed in this International Standard are required, it is recommended that they should be selected from existing International Standards, for example ISO 261, ISO 888, ISO 898, ISO 965, ISO 1461, ISO 4759/1.

2 REFERENCES

- ISO 261, *ISO general purpose metric screw threads — General plan.*
- ISO 888, *Bolts, screws and studs — Nominal lengths, and thread lengths for general purpose bolts.*
- ISO 898, *Mechanical properties of fasteners.*
- ISO 965, *ISO general purpose metric screw threads — Tolerances.*
- ISO 1461, *Metallic coatings — Hot dip galvanized coatings on fabricated ferrous products — Requirements.*
- ISO 4759/1, *Tolerances for fasteners — Part 1 : Bolts, screws and nuts with thread diameters $\geq 1,6 \leq 150$ mm and product grades A, B and C.*

3 DIMENSIONS



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Thread size d		M5	M6	M8	M10	M12	(M14)	M16
P	1)	0,8	1	1,25	1,5	1,75	2	2
b ref.	2)	16	18	22	26	30	34	38
	3)	—	—	28	32	36	40	44
	4)	—	—	—	—	—	—	57
c	max.	0,5	0,5	0,6	0,6	0,6	0,6	0,8
d_a	max.	6	7,2	10,2	12,2	14,7	16,7	18,7
d_s	max.	5,48	6,48	8,58	10,58	12,7	14,7	16,7
	min.	4,52	5,52	7,42	9,42	11,3	13,3	15,3
d_w	min.	6,7	8,7	11,4	14,4	16,4	19,2	22
e	min.	8,63	10,89	14,20	17,59	19,85	22,78	26,17
k	nom.	3,5	4	5,3	6,4	7,5	8,8	10
	min.	3,12	3,62	4,92	5,95	7,05	8,35	9,25
	max.	3,88	4,38	5,68	6,85	7,95	9,25	10,75
k'	min.	2,2	2,5	3,45	4,2	4,95	5,85	6,5
r	min.	0,2	0,25	0,4	0,4	0,6	0,6	0,6
s	max.	8	10	13	16	18	21	24
	min.	7,64	9,64	12,57	15,57	17,57	20,16	23,16

l			shank length l_s and grip length l_g													
nom.	min.	max.	l_s min.	l_g max.	l_s min.	l_g max.	l_s min.	l_g max.	l_s min.	l_g max.	l_s min.	l_g max.	l_s min.	l_g max.	l_s min.	l_g max.
25	23,95	26,05	5	9												
30	28,95	31,05	10	14												
35	33,75	36,25	15	19	12	17	6,75	13								
40	38,75	41,25	20	24	17	22	11,75	18	6,5	14						
45	43,75	46,25	25	29	22	27	16,75	23	11,5	19	6,25	15				
50	48,75	51,25	30	34	27	32	21,75	28	16,5	24	11,25	20	6	16		
55	53,5	56,5	32	37	26,75	33	21,5	29	16,25	25	11	21	7	17		
60	58,5	61,5	37	42	31,75	38	26,5	34	21,25	30	16	26	12	22		
65	63,5	66,5					36,75	43	31,5	39	26,25	35	21	31	17	27
70	68,5	71,5					41,75	48	36,5	44	31,25	40	26	36	22	32
80	78,5	81,5					51,75	58	46,5	54	41,25	50	36	46	32	42
90	88,25	91,75							56,5	64	51,25	60	46	56	42	52
100	98,25	101,75							66,5	74	61,25	70	56	66	52	62
110	108,25	111,75									71,25	80	66	76	62	72
120	118,25	121,75									81,25	90	76	86	72	82
130	128	132											80	90	76	86
140	138	142											90	100	86	96
150	148	152													96	106
160	156	164													106	116
180	176	184														
200	195,4	204,6														
220	215,4	224,6														
240	235,4	244,6														
260	254,8	265,2														
280	274,8	285,2														
300	294,8	305,2														

The popular lengths are between the stepped lines. The size M14 should be avoided if possible.

- 1) P = pitch of the thread
- 2) For nominal lengths ≤ 125 mm
- 3) For nominal lengths > 125 and ≤ 200 mm
- 4) For nominal lengths > 200 mm

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Dimensions in millimetres

M10	M12	(M14)	M16	M20	M24	M30	M36
1,5	1,75	2	2	2,5	3	3,5	4
6	30	34	38	46	54	66	78
2	36	40	44	52	60	72	84
—	—	—	57	65	73	85	97
0,6	0,6	0,6	0,8	0,8	0,8	0,8	0,8
2,2	14,7	16,7	18,7	24,4	28,4	35,4	42,4
0,58	12,7	14,7	16,7	20,84	24,84	30,84	37
0,42	11,3	13,3	15,3	19,16	23,16	29,16	35
0,4	16,4	19,2	22	27,7	33,2	42,7	51,1
0,59	19,85	22,78	26,17	32,95	39,55	50,85	60,79
0,4	7,5	8,8	10	12,5	15	18,7	22,5
0,95	7,05	8,35	9,25	11,6	14,1	17,65	21,45
0,85	7,95	9,25	10,75	13,4	15,9	19,75	23,55
0,2	4,95	5,85	6,5	8,1	9,9	12,4	15,0
0,4	0,6	0,6	0,6	0,8	0,8	1	1
6	18	21	24	30	36	46	55
0,57	17,57	20,16	23,16	29,16	35	45	53,8

Formulae :

$$l_g \text{ max.} = l \text{ nom.} - b \text{ ref.}$$

$$l_s \text{ min.} = l_g \text{ max.} - 5P$$

shank length l_s and grip length l_g																
l_g max.	l_s min.	l_g max.	l_s min.	l_g max.	l_s min.	l_g max.	l_s min.	l_g max.	l_s min.	l_g max.	l_s min.	l_g max.	l_s min.	l_g max.	l_s min.	
14																
19	6,25	15														
24	11,25	20	6	16												
29	16,25	25	11	21	7	17										
34	21,25	30	16	26	12	22										
39	26,25	35	21	31	17	27	6,5	19								
44	31,25	40	26	36	22	32	11,5	24								
54	41,25	50	36	46	32	42	21,5	34	11	26						
64	51,25	60	46	56	42	52	31,5	44	21	36	6,5	24				
74	61,25	70	56	66	52	62	41,5	54	31	46	16,5	34				
	71,25	80	66	76	62	72	51,5	64	41	56	26,5	44	12	32		
	81,25	90	76	86	72	82	61,5	74	51	66	36,5	54	22	42		
			80	90	76	86	65,5	78	55	70	40,5	58	26	46		
			90	100	86	96	75,5	88	65	80	50,5	68	36	56		
					96	106	85,5	98	75	90	60,5	78	46	66		
					106	116	95,5	108	85	100	70,5	88	56	76		
							115,5	128	105	120	90,5	108	76	96		
							135,5	148	125	140	110,5	128	96	116		
									132	147	117,5	135	103	123		
									152	167	137,5	155	123	143		
											157,5	175	143	163		
											177,5	195	163	183		
											197,5	215	183	203		

For these sizes see ISO 4018
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ANNEX

This annex is included for explanatory and informative purposes only and is not to be considered as part of this International Standard.

This International Standard incorporates some changes, primarily in width across flats, from the previous metric practice in a number of countries. These changes were made to achieve international agreement and to improve product design and utilization of material.

At its meeting in May 1977, ISO/TC 2 studied several technical reports analysing design considerations influencing determination of the best series of widths across flats for hexagon bolts, screws and nuts. A primary technical objective was to achieve a logical ratio between underhead bearing surface area (which determines the magnitude of the compressive stress on the bolted members) and the

tensile stress area of the screw thread (which governs the clamping force which can be developed by tightening the fastener).†

Table 1 lists the ratios for the sizes selected by ISO/TC 2 to be ISO standard (bold type) and in addition four sizes (light type) which currently are being produced and used in substantial quantities in many countries of the world.

The four sizes (widths across flats of 15, 17, 19 and 22 mm) will be phased out of production and use. During a transitional period, to assist designers and manufacturers, and in particular to give needed information for maintenance and repair requirements, the dimensions of the four sizes are given in table 2.

TABLE 1

Nominal thread diameter mm	Width across flats mm	Annular bearing area Thread stress area *	
5	8	1,08	
6	10	1,44	
8	13	1,23	
10	15	0,90	
	16	1,30	
	17	1,73	
12	18	0,91	
	19	1,16	
14	21	0,96	
	22	1,24	
16	24	1,02	
20	30	0,95	
24	36	0,86	
30	46	1,02	
36	55	1,04	

* Calculation based on clearance holes ISO 273 (revised), medium series.

TABLE 2

Thread size <i>d</i>		M10	M12	M14
<i>P</i>	1)	1,5	1,75	2
<i>b</i> ref.	2)	26	30	34
	3)	32	36	40
<i>c</i>	max.	0,6	0,6	0,6
<i>d_a</i>	max.	12,2	14,7	16,7
<i>d_w</i>	min.	13,4	15,4	17,4
	max.	10,58	12,7	14,7
<i>d_s</i>	min.	9,42	11,3	13,3
<i>e</i>	min.	16,64	18,72	20,88
	nom.	6,4	7,5	8,8
<i>k</i>	min.	5,95	7,05	8,35
	max.	6,85	7,95	9,25
<i>k'</i>	min.	4,2	4,95	5,85
<i>r</i>	min.	0,4	0,6	0,6
<i>s</i>	max.	15	17	19
	min.	14,57	16,57	18,48

- 1) *P* = pitch of the thread
- 2) For nominal lengths ≤ 125 mm
- 3) For nominal length > 125 mm and ≤ 200 mm

† The calculation technique is presented in TC 2/WG 4 N 43 and the ratios computed for all of the various width across flats/product size combinations examined by ISO/TC 2 are given in document TC 2 N 699.