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International Standard 4015

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

Hexagon head bolts — Product grade B — Reduced shank (shank diameter ≈ pitch diameter)

Boulons à tête hexagonale — Classe de produit B — Tige réduite (diamètre de tige ≈ diamètre sur flanc de filet)

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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 4015 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	Hungary	Poland
Belgium	India	Romania
Canada	Ireland	South Africa, Rep. of
Chile	Israel	Spain
Czechoslovakia	Korea, Rep. of	Sweden
Denmark	Mexico	USA
Egypt, Arab Rep. of	Netherlands	Yugoslavia
Finland	New Zealand	
Germany, F.R.	Norway	

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

France
United Kingdom
USSR

Printed in Switzerland

Hexagon head bolts — Product grade B — Reduced shank (shank diameter ≈ pitch diameter)

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 3 up to and including 20 mm, with reduced shank (shank diameter ≈ pitch diameter), of product grade B.

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.

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.*

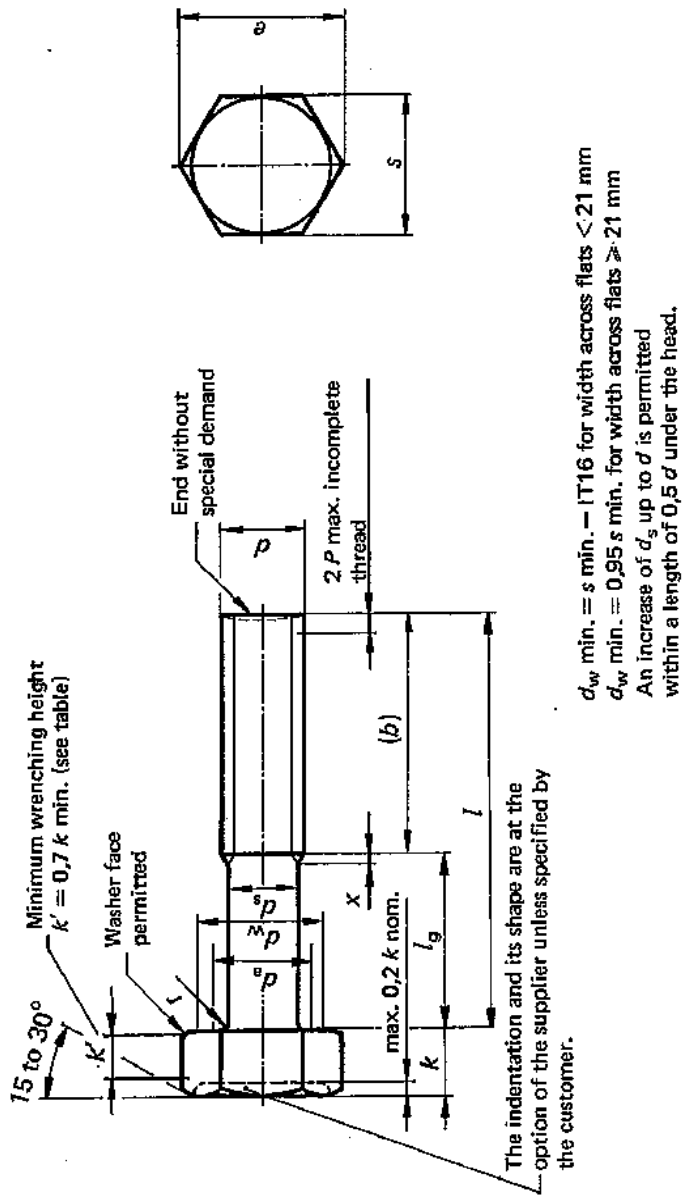
ISO 965, *ISO general purpose metric screw threads — Tolerances.*

ISO 3506, *Corrosion-resistant stainless steel fasteners — Specifications.*[1)]

ISO 4759/I, *Tolerances for fasteners — Part I : Bolts, screws and nuts with thread diameters* ⩾ 1,6 ⩽ 150 mm *and product grades A, B and C.*

1) At present at the stage of draft.

3 DIMENSIONS



d_w min. = s min. – IT16 for width across flats < 21 mm
d_w min. = 0,95 s min. for width across flats ≥ 21 mm
An increase of d_s up to d is permitted within a length of 0,5 d under the head.

Dimensions in millimetres

Thread size d			M3	M4	M5	M6	M8	M10	M12	(M14)	M16	M20
P		1)	0,5	0,7	0,8	1	1,25	1,5	1,75	2	2	2,5
b ref.		2)	12	14	16	18	22	26	30	34	38	46
		3)	—	—	—	—	28	32	36	40	44	52
d_a		max.	3,6	4,7	5,7	6,8	9,2	11,2	13,7	15,7	17,7	22,4
d_s		≈	2,6	3,5	4,4	5,3	7,1	8,9	10,7	12,5	14,5	18,2
d_w		min.	4,4	5,7	6,7	8,7	11,4	14,4	16,4	19,2	22	27,7
e		min.	5,98	7,50	8,63	10,89	14,20	17,59	19,85	22,78	26,17	32,95
k		nom.	2	2,8	3,5	4	5,3	6,4	7,5	8,8	10	12,5
		min.	1,80	2,60	3,26	3,76	5,06	6,11	7,21	8,51	9,71	12,15
		max.	2,20	3,00	3,74	4,24	5,54	6,69	7,79	9,09	10,29	12,85
k'		min.	1,3	1,8	2,3	2,6	3,5	4,3	5,1	6	6,8	8,5
r		min.	0,1	0,2	0,2	0,25	0,4	0,4	0,6	0,6	0,6	0,8
s		max.	5,5	7	8	10	13	16	18	21	24	30
		min.	5,20	6,64	7,64	9,64	12,57	15,57	17,57	20,16	23,16	29,16
x		max.	1,25	1,75	2	2,5	3,2	3,8	4,3	5	5	6,3

l			l_g		l_g		l_g		l_g		l_g		l_g		l_g		l_g		l_g		l_g	
nom.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
20	18,95	21,05	7	8	4,6	6																
25	23,95	26,05	12	13	9,6	11	7,4	9	5	7												
30	28,95	31,05	17	18	14,6	16	12,4	14	10	12	5,5	8										
35	33,75	36,25			19,6	21	17,4	19	15	17	10,5	13										
40	38,75	41,25			24,6	26	22,4	24	20	22	15,5	18	11	14								
45	43,75	46,25					27,4	29	25	27	20,5	23	16	19	11,5	15						
50	48,75	51,25					32,4	34	30	32	25,5	28	21	24	16,5	20	12	16				
55	53,5	56,5							35	37	30,5	33	26	29	21,5	25	17	21	13	17		
60	58,5	61,5							40	42	35,5	38	31	34	26,5	30	22	26	18	22		
65	63,5	66,5									40,5	43	36	39	31,5	35	27	31	23	27	14	19
70	68,5	71,5									45,5	48	41	44	36,5	40	32	36	28	32	19	24
80	78,5	81,5									55,5	58	51	54	46,5	50	42	46	38	42	29	34
90	88,25	91,75											61	64	56,5	60	52	56	48	52	39	44
100	98,25	101,75											71	74	66,5	70	62	66	58	62	49	54
110	108,25	111,75													76,5	80	72	76	68	72	59	64
120	118,25	121,75													86,5	90	82	86	78	82	69	74
130	128	132															86	90	82	86	73	70
140	138	142															96	100	92	96	83	88
150	148	152																	102	106	93	98

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

Formulae : l_g max. $= l$ nom. $- b$ ref.

l_g min. $= l_g$ max. $- 2P$

1) P = pitch of the thread.

2) For nominal lengths ⩽ 125 mm.

3) For nominal lengths > 125 and ⩽ 200 mm.

4 SPECIFICATIONS AND REFERENCE STANDARDS

Material		Steel	Stainless steel	Non-ferrous metal
Thread	Tolerance	6 g		
	International Standards	ISO 261, ISO 965		
Mechanical properties	Classes	5.8 – 8.8	A2-70	.....
	International Standard	ISO 898/1	ISO 3506	ISO . . .[1]
Tolerances	Product grade	B		
	International Standard	ISO 4759/1		
Finish		as processed	plain	plain
		Requirements for electroplating are covered in ISO . . .[1] If different electroplating requirements are desired or if requirements are needed for other finishes they should be negotiated between customer and supplier.		
Acceptability		For acceptance procedure see ISO . . .[1]		

1) In preparation.

5 DESIGNATION

Example for the designation of a hexagon head bolt with thread size $d = M12$, nominal length $l = 80$ mm and property class 8.8 :

Hexagon head bolt ISO 4015 M12 × 80-8.8

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	$\frac{\text{Annular bearing area}}{\text{Thread stress area}}$ *
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 d		M10		M12	M14
P	1)	1,5		1,75	2
$b\,^{+2P}_{0}$	2)	26		30	34
	3)	32		36	40
d_a	max.	11,2		13,7	16,7
d_s	≈	8,9		10,7	12,5
d_w	min.	13,5	16,3	17,1	19,8
e	min.	16,46	18,72	20,88	23,91
k	nom.	6,4		7,5	8,8
	min.	6,11		7,21	8,51
	max.	6,69		7,79	9,09
k'	min.	4,3		5,1	6,0
r	min.	0,4		0,6	0,6
s	max.	15	17	19	22
	min.	14,57	16,57	18,48	21,16
x	max.	3,8		4,3	5

1) P = pitch of the thread.

2) For nominal lengths ≤ 125 mm.

3) For nominal lengths > 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.