

INTERNATIONAL  
STANDARD

ISO  
4016

Third edition  
1999-08-15

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**Hexagon head bolts — Product grade C**

*Vis à tête hexagonale partiellement filetées — Grade C*

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Reference number  
ISO 4016:1999(E)

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 4016 was prepared by Technical Committee ISO/TC 2, *Fasteners*.

This third edition cancels and replaces the second edition (ISO 4016:1988) which has been technically revised.

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## Introduction

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

- a) hexagon head bolts (ISO 4014 to ISO 4016 and ISO 8765);
- b) hexagon head screws (ISO 4017, ISO 4018 and ISO 8676);
- c) hexagon nuts (ISO 4032 to ISO 4036, ISO 8673 to ISO 8675);
- d) hexagon bolts with flange (ISO 4162 and ISO 15071);
- e) hexagon nuts with flange (ISO 4161 and ISO 10663);
- f) structural bolts and nuts (ISO 4775, ISO 7411 to ISO 7414 and ISO 7417).

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# Hexagon head bolts — Product grade C

## 1 Scope

This International Standard specifies the characteristics of hexagon head bolts with threads from M5 up to and including M64 of product grade C.

If, in special cases, specifications other than those listed in this International Standard are required, they should be selected from existing International Standards, for example ISO 724, ISO 888, ISO 898-1, ISO 965-1 and ISO 4759-1.

## 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 225:1983, *Fasteners — Bolts, screws, studs and nuts — Symbols and designations of dimensions.*

ISO 724:1993, *ISO general-purpose metric screw threads — Basic dimensions.*

ISO 888:1976, *Bolts, screws and studs — Nominal lengths, and thread lengths for general purpose bolts.*

ISO 898-1:1999, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 1: Bolts, screws and studs.*

ISO 965-1:1998, *ISO general purpose metric screw threads — Tolerances — Part 1: Principles and basic data.*

ISO 3269:—<sup>1)</sup>, *Fasteners — Acceptance inspection.*

ISO 4018:1999, *Hexagon head screws — Product grade C.*

ISO 4042:1999, *Fasteners — Electroplated coatings.*

ISO 4759-1:—<sup>2)</sup>, *Tolerances for fasteners — Part 1: Bolts, screws, studs and nuts — Product grades A, B and C.*

ISO 8992:1986, *Fasteners — General requirements for bolts, screws, studs and nuts.*

ISO 10683:—<sup>3)</sup>, *Fasteners — Non-electrolytically applied zinc flake coatings.*

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<sup>1)</sup> To be published. (Revision of ISO 3269:1988)

<sup>2)</sup> To be published. (Revision of ISO 4759-1:1978)

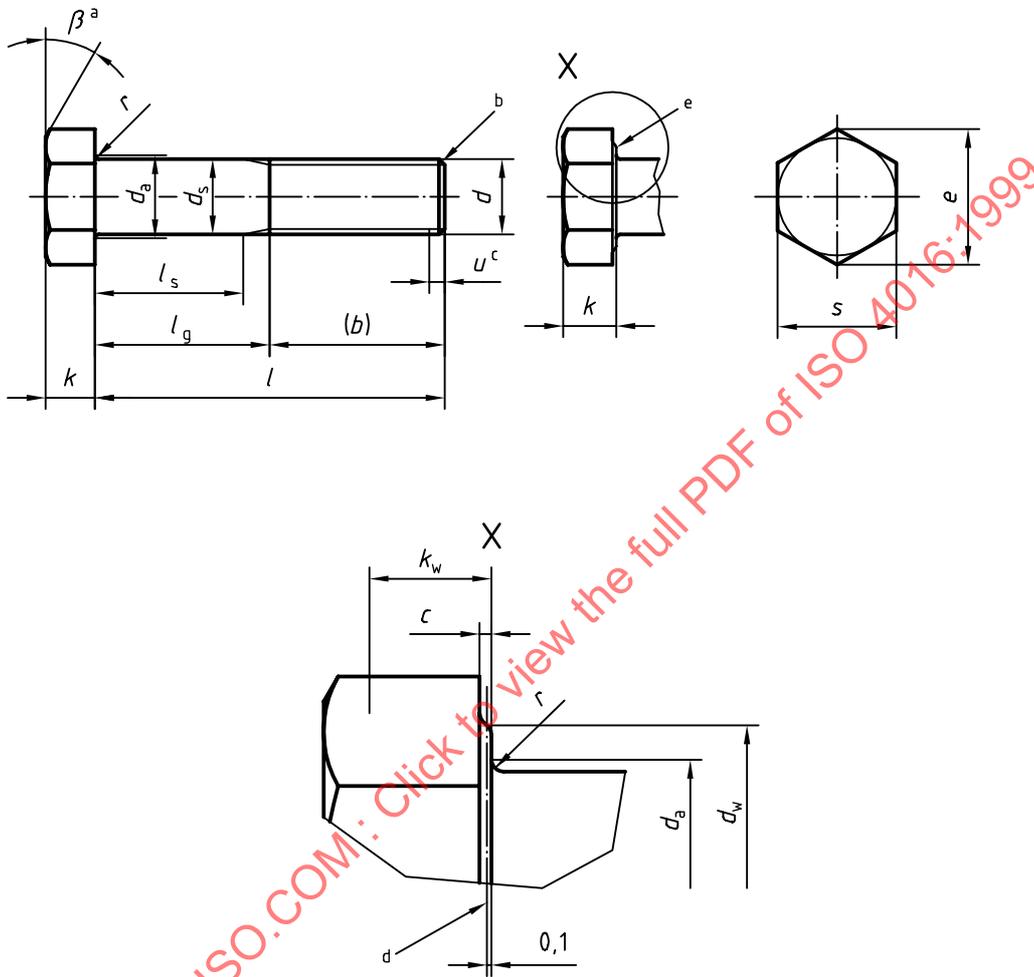
<sup>3)</sup> To be published.

### 3 Dimensions

See Figure 1 and Tables 1 and 2.

Symbols and designations of dimensions are defined in ISO 225.

Dimensions in millimetres



- a  $\beta = 15^\circ$  to  $30^\circ$
- b End without special requirements
- c Incomplete thread  $u \leq 2P$
- d Reference datum for  $d_w$
- e Washer face permissible

Figure 1

Table 1 — Preferred threads

Dimensions in millimetres

Thread ( <i>d</i> )		M5	M6	M8	M10	M12	M16	M20								
<i>p</i> <sup>a</sup>		0,8	1	1,25	1,5	1,75	2	2,5								
<i>b</i> ref.	<i>b</i>	16	18	22	26	30	38	46								
	<i>c</i>	22	24	28	32	36	44	52								
	<i>d</i>	35	37	41	45	49	57	65								
<i>c</i>	max.	0,5	0,5	0,6	0,6	0,6	0,8	0,8								
<i>d</i> <sub>a</sub>	max.	6	7,2	10,2	12,2	14,7	18,7	24,4								
<i>d</i> <sub>s</sub>	max.	5,48	6,48	8,58	10,58	12,7	16,7	20,84								
	min.	4,52	5,52	7,42	9,42	11,3	15,3	19,16								
<i>d</i> <sub>w</sub>	min.	6,74	8,74	11,47	14,47	16,47	22	27,7								
<i>e</i>	min.	8,63	10,89	14,2	17,59	19,85	26,17	32,95								
<i>k</i>	nom.	3,5	4	5,3	6,4	7,5	10	12,5								
	max.	3,875	4,375	5,675	6,85	7,95	10,75	13,4								
	min.	3,125	3,625	4,925	5,95	7,05	9,25	11,6								
<i>k</i> <sub>w</sub> <sup>e</sup>	min.	2,19	2,54	3,45	4,17	4,94	6,48	8,12								
<i>r</i>	min.	0,2	0,25	0,4	0,4	0,6	0,6	0,8								
<i>s</i>	nom. = max.	8,00	10,00	13,00	16,00	18,00	24,00	30,00								
	min.	7,64	9,64	12,57	15,57	17,57	23,16	29,16								
<i>l</i>			<i>l</i> <sub>s</sub> and <i>l</i> <sub>g</sub> <sup>f g</sup>													
			<i>l</i> <sub>s</sub> min.	<i>l</i> <sub>g</sub> max.	<i>l</i> <sub>s</sub> min.	<i>l</i> <sub>g</sub> max.	<i>l</i> <sub>s</sub> min.	<i>l</i> <sub>g</sub> max.	<i>l</i> <sub>s</sub> min.	<i>l</i> <sub>g</sub> max.	<i>l</i> <sub>s</sub> min.	<i>l</i> <sub>g</sub> max.	<i>l</i> <sub>s</sub> min.	<i>l</i> <sub>g</sub> max.	<i>l</i> <sub>s</sub> min.	<i>l</i> <sub>g</sub> max.
nom.	min.	max.	5	9	7	12	For sizes above the solid, boldface stepped line, ISO 4018 is recommended									
25	23,95	26,05	10	14	12	17	11,75	18	11,5	19						
30	28,95	31,05	15	19	12	17	16,75	23	16,5	24						
35	33,75	36,25	20	24	17	22	21,75	28	21,5	29	16,25	25				
40	38,75	41,25	25	29	22	27	26,75	33	26,5	34	21,25	30				
45	43,75	46,25	30	34	27	32	31,75	38	31,5	39	26,25	35	17	27		
50	48,75	51,25			32	37	36,75	43	36,5	44	31,25	40	22	32		
55	53,5	56,5			37	42	41,75	48	41,5	50	32	42	21,5	34		
60	58,5	61,5			41,75	58	51,75	58	46,5	54	41,25	50	32	42	21,5	34
65	63,5	66,5							56,5	64	51,25	60	42	52	31,5	44
70	68,5	71,5							66,5	74	61,25	70	52	62	41,5	54
80	78,5	81,5									71,25	80	62	72	51,5	64
90	88,25	91,75									81,25	90	72	82	61,5	74
100	98,25	101,75											76	86	65,5	78
110	108,25	111,75											86	96	75,5	88
120	118,25	121,75											96	106	85,5	98
130	128	132											106	116	95,5	108
140	138	142													115,5	128
150	148	152													135,5	148
160	156	164														
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														
320	314,3	325,7														
340	334,3	345,7														
360	354,3	365,7														
380	374,3	385,7														
400	394,3	405,7														
420	413,7	426,3														
440	433,7	446,3														
460	453,7	466,3														
480	473,7	486,3														
500	493,7	506,3														

Table 1 (continued)

Thread (d)		M24	M30	M36	M42	M48	M56	M64								
$p^a$		3	3,5	4	4,5	5	5,5	6								
b ref.	b	54	66	—	—	—	—	—								
	c	60	72	84	96	108	—	—								
	d	73	85	97	109	121	137	153								
c	max.	0,8	0,8	0,8	1	1	1	1								
$d_a$	max.	28,4	35,4	42,4	48,6	56,6	67	75								
$d_s$	max.	24,84	30,84	37	43	49	57,2	65,2								
	min.	23,16	29,16	35	41	47	54,8	62,8								
$d_w$	min.	33,25	42,75	51,11	59,95	69,45	78,66	88,16								
e	min.	39,55	50,85	60,79	71,3	82,6	93,56	104,86								
k	nom.	15	18,7	22,5	26	30	35	40								
	max.	15,9	19,75	23,55	27,05	31,05	36,25	41,25								
	min.	14,1	17,65	21,45	24,95	28,95	33,75	38,75								
$k_w^e$	min.	9,87	12,36	15,02	17,47	20,27	23,63	27,13								
r	min.	0,8	1	1	1,2	1,6	2	2								
s	nom. = max.	36	46	55,0	65,0	75,0	85,0	95,0								
	min.	35	45	53,8	63,1	73,1	82,8	92,8								
l		$l_s$ and $l_g^{f,g}$														
		$l_s$ 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.	
nom.	min.	max.														
25	23,95	26,05														
30	28,95	31,05	For sizes above the solid, boldface stepped line, ISO 4018 is recommended													
35	33,75	36,25														
40	38,75	41,25														
45	43,75	46,25														
50	48,75	51,25														
55	53,5	56,5														
60	58,5	61,5														
65	63,5	66,5														
70	68,5	71,5														
80	78,5	81,5														
90	88,25	91,75														
100	98,25	101,75	31	46												
110	108,25	111,75	41	56												
120	118,25	121,75	51	66	36,5	54										
130	128	132	55	70	40,5	58										
140	138	142	65	80	50,5	68	36	56								
150	148	152	75	90	60,5	78	46	66								
160	156	164	85	100	70,5	88	56	76								
180	176	184	105	120	90,5	108	76	96	61,5	84						
200	195,4	204,6	125	140	110,5	128	96	116	81,5	104	67	92				
220	215,4	224,6	132	147	117,5	135	103	123	88,5	111	74	99				
240	235,4	244,6	152	167	137,5	155	123	143	108,5	131	94	119	75,5	103		
260	254,8	265,2			157,5	175	143	163	128,5	151	114	139	95,5	123	77	
280	274,8	285,2			177,5	195	163	183	148,5	171	134	159	115,5	143	97	
300	294,8	305,2			197,5	215	183	203	168,5	191	154	179	135,5	163	117	
320	314,3	325,7					203	223	188,5	211	174	199	155,5	183	137	
340	334,3	345,7					223	243	208,5	231	194	219	175,5	203	157	
360	354,3	365,7					243	263	228,5	251	214	239	195,5	223	177	
380	374,3	385,7							248,5	271	234	259	215,5	243	197	
400	394,3	405,7							268,5	291	254	279	235,5	263	217	
420	413,7	426,3							288,5	311	274	299	255,5	283	237	
440	433,7	446,3									294	319	275,5	303	257	
460	453,7	466,3									314	339	295,5	323	277	
480	473,7	486,3									334	359	315,5	343	297	
500	493,7	506,3											335,5	363	317	

NOTE popular lengths are defined in terms of  $l_s$  and  $l_g$

<sup>a</sup>  $p$  is the pitch of the thread.

<sup>b</sup> For lengths  $l_{nom} \leq 125$  mm.

<sup>c</sup> For lengths  $125$  mm  $< l_{nom} \leq 200$  mm.

<sup>d</sup> For lengths  $l_{nom} > 200$  mm.

<sup>e</sup>  $k_w, min = 0,7 k_{min}$

<sup>f</sup>  $l_g, max = l_{nom} - b$

$l_s, min = l_g, max - 5P$

<sup>g</sup>  $l_g$  is the minimum grip length.

Table 2 — Non-preferred threads

Dimensions in millimetres

Thread ( <i>d</i> )			M14	M18	M22	M27	M33					
<i>p</i> <sup>a</sup>			2	2,5	2,5	3	3,5					
<i>b</i> ref.	<i>b</i>		34	42	50	60	—					
	<i>c</i>		40	48	56	66	78					
	<i>d</i>		53	61	69	79	91					
<i>c</i>	max.		0,6	0,8	0,8	0,8	0,8					
<i>d</i> <sub>a</sub>	max.		16,7	21,2	26,4	32,4	38,4					
<i>d</i> <sub>s</sub>	max.		14,7	18,7	22,84	27,84	34					
	min.		13,3	17,3	21,16	26,16	32					
<i>d</i> <sub>w</sub>	min.		19,15	24,85	31,35	38	46,55					
<i>e</i>	min.		22,78	29,56	37,29	45,2	53,37					
<i>k</i>	nom.		8,8	11,5	14	17	21					
	max.		9,25	12,4	14,9	17,9	22,05					
	min.		8,35	10,6	13,1	16,1	19,95					
<i>k</i> <sub>w</sub> <sup>e</sup>	min.		5,85	7,42	9,17	11,27	13,97					
<i>r</i>	min.		0,6	0,6	0,8	1	1					
<i>s</i>	nom. = max.		21,00	27,00	34	41	50					
	min.		20,16	26,16	33	40	49					
<i>l</i>			<i>l</i> <sub>s</sub> and <i>l</i> <sub>g</sub> <sup>f g</sup>									
nom.	min.	max.	<i>l</i> <sub>s</sub> min.	<i>l</i> <sub>g</sub> max.	<i>l</i> <sub>s</sub> min.	<i>l</i> <sub>g</sub> max.	<i>l</i> <sub>s</sub> min.	<i>l</i> <sub>g</sub> max.	<i>l</i> <sub>s</sub> min.	<i>l</i> <sub>g</sub> max.	<i>l</i> <sub>s</sub> min.	<i>l</i> <sub>g</sub> max.
60	58,5	61,5	16	26	For sizes above the solid, boldface stepped line ISO 4018 is recommended							
65	63,5	66,5	21	31								
70	68,5	71,5	26	36								
80	78,5	81,5	36	46	25,5	38						
90	88,25	91,75	46	56	35,5	48	27,5	40				
100	98,25	101,75	56	66	45,5	58	37,5	50				
110	108,25	111,75	66	76	55,5	68	47,5	60	35	50		
120	118,25	121,75	76	86	65,5	78	57,5	70	45	60		
130	128	132	80	90	69,5	82	61,5	74	49	64	34,5	52
140	138	142	90	100	79,5	92	71,5	84	59	74	44,5	62
150	148	152			89,5	102	81,5	94	69	84	54,5	72
160	156	164			99,5	112	91,5	104	79	94	64,5	82
180	176	184			119,5	132	111,5	124	99	114	84,5	102
200	195,4	204,6					131,5	144	119	134	104,5	122
220	215,4	224,6					138,5	151	126	141	111,5	129
240	235,4	244,6							146	161	131,5	149
260	254,8	265,2							166	181	151,5	167
280	274,8	285,2									171,5	189
300	294,8	305,2									191,5	209
320	314,3	325,7									211,5	229
340	334,3	345,7										
360	354,3	365,7										
380	374,3	385,7										
400	394,3	405,7										
420	413,7	426,3										
440	433,7	446,3										
460	453,7	466,3										
480	473,7	486,3										
500	493,7	506,3										

Table 2 (continued)

Thread (d)			M39	M45	M52	M60				
<i>p</i> <sup>a</sup>			4	4,5	5	5,5				
<i>b</i> ref.	b	—	—	—	—	—				
	c	90	102	116	—	—				
	d	103	115	129	145	—				
<i>c</i>	max.	1	1	1	1	—				
<i>d</i> <sub>a</sub>	max.	45,4	52,6	62,6	71	—				
<i>d</i> <sub>s</sub>	max.	40	46	53,2	61,2	—				
	min.	38	44	50,8	58,8	—				
<i>d</i> <sub>w</sub>	min.	55,86	64,7	74,2	83,41	—				
<i>e</i>	min.	66,44	76,95	88,25	99,21	—				
<i>k</i>	nom.	25	28	33	38	—				
	min.	23,95	26,95	31,75	36,75	—				
	max.	26,05	29,05	34,25	39,25	—				
<i>k</i> <sub>w</sub> <sup>e</sup>	min.	16,77	18,87	22,23	25,73	—				
<i>r</i>	min.	1	1,2	1,6	2	—				
<i>s</i>	nom. = max.	60,0	70,0	80,0	90,0	—				
	min.	58,8	68,1	78,1	87,8	—				
<i>l</i>			<i>l</i> <sub>s</sub> and <i>l</i> <sub>g</sub> <sup>f g</sup>							
nom.	min.	max.	<i>l</i> <sub>s</sub> min.	<i>l</i> <sub>g</sub> max.	<i>l</i> <sub>s</sub> min.	<i>l</i> <sub>g</sub> max.	<i>l</i> <sub>s</sub> min.	<i>l</i> <sub>g</sub> max.	<i>l</i> <sub>s</sub> min.	<i>l</i> <sub>g</sub> max.
60	58,5	61,5								
65	63,5	66,5	For sizes above the solid, boldface stepped line ISO 4018 is recommended							
70	68,5	71,5								
80	78,5	81,5								
90	88,25	91,75								
100	98,25	101,75								
110	108,25	111,75								
120	118,25	121,75								
130	128	132								
140	138	142								
150	148	152	40	60						
160	156	164	50	70						
180	176	184	70	90	55,5	78				
200	195,4	204,6	90	110	75,5	98	59	84		
220	215,4	224,6	97	117	82,5	105	66	91		
240	235,4	244,6	117	137	102,5	125	86	111	67,5	95
260	254,8	265,2	137	157	122,5	145	106	131	87,5	115
280	274,8	285,2	157	177	142,5	165	126	151	107,5	135
300	294,8	305,2	177	197	162,5	185	146	171	127,5	155
320	314,3	325,7	197	217	182,5	205	166	191	147,5	175
340	334,3	345,7	217	237	202,5	225	186	211	167,5	195
360	354,3	365,7	237	257	222,5	245	206	231	187,5	215
380	374,3	385,7	257	277	242,5	265	226	251	207,5	235
400	394,3	405,7	277	297	262,5	285	246	271	227,5	255
420	413,7	426,3			282,5	305	266	291	247,5	275
440	433,7	446,3			302,5	325	286	311	267,5	295
460	453,7	466,3					306	331	287,5	315
480	473,7	486,3					326	351	307,5	335
500	493,7	506,3					346	371	327,5	355
NOTE popular lengths are defined in terms of <i>l</i> <sub>s</sub> and <i>l</i> <sub>g</sub>										
<sup>a</sup> <i>P</i> is the pitch of the thread.					<sup>e</sup> <i>k</i> <sub>w</sub> , min = 0,7 <i>k</i> <sub>min</sub>					
<sup>b</sup> For lengths <i>l</i> <sub>nom</sub> ≤ 125 mm.					<sup>f</sup> <i>l</i> <sub>g</sub> , max = <i>l</i> <sub>nom</sub> - <i>b</i>					
<sup>c</sup> For lengths 125 mm < <i>l</i> <sub>nom</sub> ≤ 200 mm.					<i>l</i> <sub>s</sub> , min = <i>l</i> <sub>g</sub> , max - 5 <i>P</i>					
<sup>d</sup> For lengths <i>l</i> <sub>nom</sub> > 200 mm.					<sup>g</sup> <i>l</i> <sub>g</sub> is the minimum grip length.					

## 4 Specifications and reference standards

See Table 3.

**Table 3 — Specifications and reference standards**

<b>Material</b>		Steel
<b>General requirements</b>	International Standard	ISO 8992
<b>Thread</b>	Tolerance	8g
	International Standards	ISO 724, ISO 965-1
<b>Mechanical properties</b>	Property class <sup>a</sup>	$d \leq 39$ mm: 3.6, 4.6, 4.8 $d > 39$ mm: as agreed
	International Standard	$d \leq 39$ mm: ISO 898-1 $d > 39$ mm: as agreed
<b>Tolerances</b>	Product grade	C
	International Standard	ISO 4759-1
<b>Finish and/or coating</b>		As processed  Requirements for electroplating are covered in ISO 4042.  Requirements for non-electrolytically applied zinc flake coatings are covered in ISO 10683.  If different electroplating requirements are desired or if requirements are needed for other finishes, they should be agreed between customer and supplier.
<b>Acceptability</b>		For acceptance procedure, see ISO 3269.
<sup>a</sup> For other property classes see ISO 898-1.		

## 5 Designation

EXAMPLE

A hexagon head bolt, product grade C, with thread M12, nominal length  $l = 80$  mm and property class 4.6 is designated as follows:

**Hexagon head bolt ISO 4016 - M12 × 80 - 4.6**