

Tolerances for fasteners —

Part 1: Bolts, screws, studs and nuts — Product grades A, B and C

The European Standard EN ISO 4759-1:2000 has the status of a
British Standard

ICS 21.060.10; 21.060.20

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National foreword

This British Standard is the official English language version of EN ISO 4759-1:2000. It is identical with ISO 4759-1:2000. It supersedes BS 6322-1:1982 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee FME/9, Bolts, nuts and accessories (+QA and hose clamps), to Subcommittee FME/9/3, Reference standards for fasteners (+tolerance standards), which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

Cross-references

Attention is drawn to the fact that CEN and CENELEC Standards normally include an annex which lists normative references to international publications with their corresponding European publications. The British Standards which implement these international or European publications may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Find” facility of the BSI Standards Electronic Catalogue.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN ISO title page, the EN ISO foreword page, the ISO title page, pages ii to iv, pages 1 to 58, an inside back cover and a back cover

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**Tolerances for fasteners - Part 1: Bolts, screws, studs and nuts -
Product grades A, B and C (ISO 4759-1:2000)**

Tolérances des éléments de fixation - Partie 1: Vis, goujons
et écrous - Grades A, B et C (ISO 4759-1:2000)

Toleranzen für Verbindungselemente - Teil 1: Schrauben
und Muttern - Produktklassen A, B und C (ISO 4759-
1:2000)

This European Standard was approved by CEN on 7 October 2000.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

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Foreword

The text of the International Standard ISO 4759-1:2000 has been prepared by Technical Committee ISO/TC 2 "Fasteners" in collaboration with Technical Committee CEN/TC 185 "Threaded and non-threaded mechanical fasteners and accessories", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2001, and conflicting national standards shall be withdrawn at the latest by May 2001.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

NOTE FROM CEN/CS: The foreword is susceptible to be amended on reception of the German language version. The confirmed or amended foreword, and when appropriate, the normative annex ZA for the references to international publications with their relevant European publications will be circulated with the German version.

Endorsement notice

The text of the International Standard ISO 4759-1:2000 was approved by CEN as a European Standard without any modification.

INTERNATIONAL STANDARD

EN ISO 4759-1:2000

ISO
4759-1

Second edition
2000-11-15

Tolerances for fasteners —

Part 1:

Bolts, screws, studs and nuts — Product grades A, B and C

Tolérances des éléments de fixation —

Partie 1: Vis, goujons et écrous — Grades A, B et C



Reference number
ISO 4759-1:2000(E)

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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.

Attention is drawn to the possibility that some of the elements of this part of ISO 4759 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 4759-1 was prepared by Technical Committee ISO/TC 2, *Fasteners*, Subcommittee SC 7, *Reference Standards for fasteners (mainly covering terminology, dimensioning, sizes and tolerancing)*.

This second edition cancels and replaces the first edition (ISO 4759-1:1978), which has been technically revised.

ISO 4759 consists of the following parts, under the general title *Tolerances for fasteners*:

- *Part 1: Bolts, screws, studs and nuts — Product grades A, B and C*
- *Part 3: Plain washers for bolts, screws and nuts — Product grades A and C*

Annexes A to C of this part of ISO 4759 are for information only.

Tolerances for fasteners —

Part 1:

Bolts, screws, studs and nuts — Product grades A, B and C

1 Scope

This part of ISO 4759 specifies a selection of tolerances for bolts, screws, studs and nuts with ISO metric threads and with product grades A, B and C and for tapping screws with product grade A.

NOTE The product grades refer to the size of the tolerances where grade A is the most precise and grade C is the least precise.

The tolerances, except tolerances for threads, are selected from the system of limits and fits specified in ISO 286-1 and ISO 286-2. The tolerances for metric threads are taken from the series of tolerance classes specified in ISO 965-3. The tolerances for tapping screw threads are covered in ISO 1478.

The tolerances of form and position are specified and indicated in accordance with ISO 1101, ISO 8015 and ISO 2692.

The tolerances specified in this part of ISO 4759 apply to fasteners prior to coating unless otherwise specified. See also ISO 4042.

Deviations from the tolerances specified in this part of ISO 4759 are only permitted in product standards where there are valid technical reasons. In cases where there is a difference between the tolerance requirements in this part of ISO 4759 and the product standard, the product standard takes precedence.

It is recommended that these tolerances also be used for non-standard fasteners.

Dimensions and tolerances given in this part of ISO 4759 are in millimetres.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 4759. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 4759 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 designation of dimensions*.

ISO 286-1:1988, *ISO system of limits and fits — Part 1: Bases of tolerances, deviations and fits*.

ISO 286-2:1988, *ISO system of limits and fits — Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts*.

ISO 885:2000, *General purpose bolts and screws — Metric series — Radii under the head*.

ISO 965-3:1998, *ISO general purpose metric screw threads — Tolerances — Part 3: Deviations for constructional screw threads*.

ISO 1101:2000, *Geometrical Product Specifications (GPS) — Geometrical tolerancing — Tolerances of form, orientation, location and run-out*.

ISO 1478:1999, *Tapping screws thread*.

ISO 1479:1983, *Hexagon head tapping screws*.

ISO 2692:1988, *Technical drawings — Geometrical tolerancing — Maximum material principle*.

ISO 4032:1999, *Hexagon nuts, style 1 — Product grades A and B*.

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

ISO 4757:1983, *Cross recesses for screws*.

ISO 7053:1992, *Hexagon washer head tapping screws*.

ISO 7721:1983, *Countersunk head screws — Head configuration and gauging*.

ISO 8015:1985, *Technical drawings — Fundamental tolerancing principle*.

ISO 10509:1992, *Hexagon flange head tapping screws*.

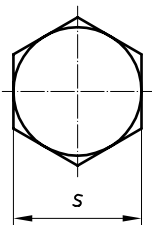
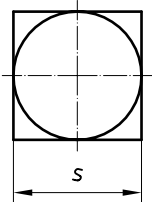
ISO 10642:1997, *Hexagon socket countersunk head screws*.

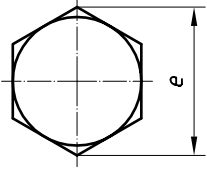
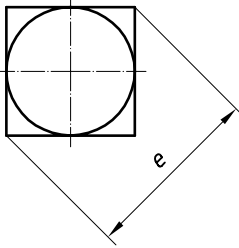
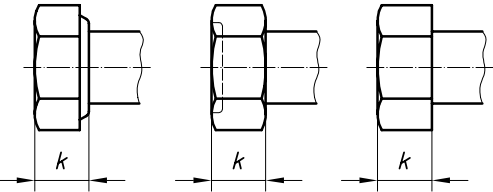
ISO 10664:1999, *Hexalobular internal driving feature for bolts and screws*.

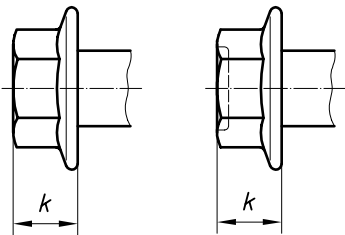
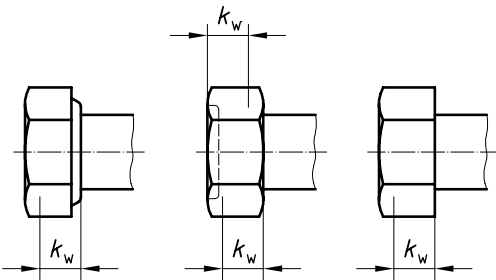
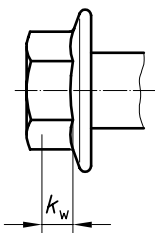
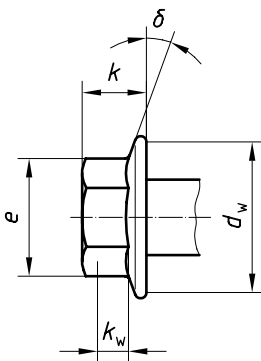
3 Tolerances for metric bolts, screws and studs

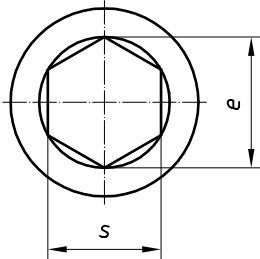
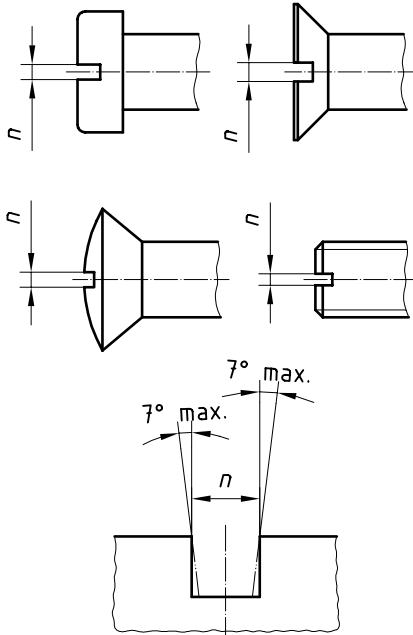
3.1 Dimensional tolerances

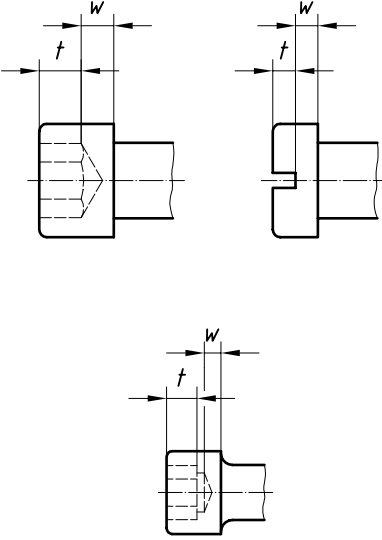
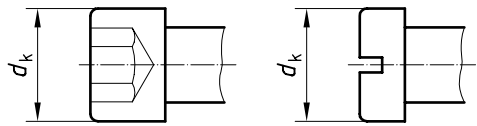
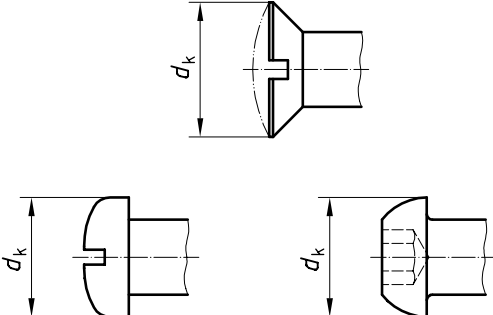
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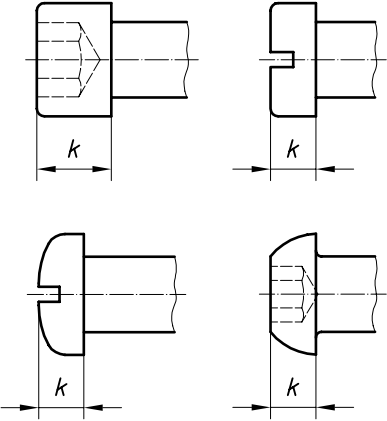
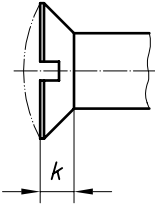
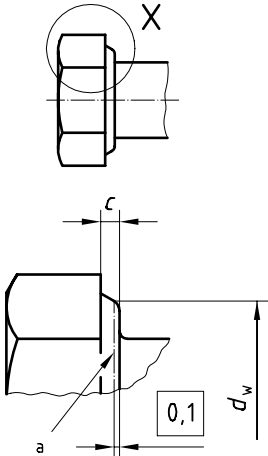
Feature	Tolerance for product grades			Notes
	A	B	C	
3.1.1 Tolerance level				
Shank and bearing surface	close	close	wide	
Other features	close	wide	wide	
3.1.2 External thread	6g	6g	8g (but 6g for property class 8.8 and higher)	For certain products and coatings, other tolerance classes for threads may be specified in the relevant product and coating standards.
3.1.3 Driving features				
3.1.3.1 External	<i>s</i>	Tolerance	<i>s</i>	Tolerance
3.1.3.1.1 Width across flats	≤ 30	h13	≤ 18	h14
	> 30	h14	> 18 ≤ 60	h15
			> 60 ≤ 180	h16
			> 180	h17
 Figure 1  Figure 2				

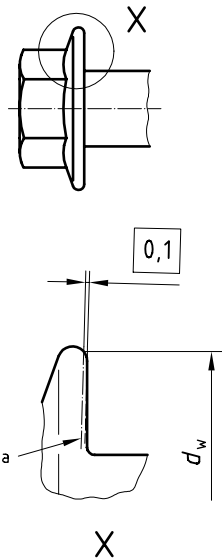
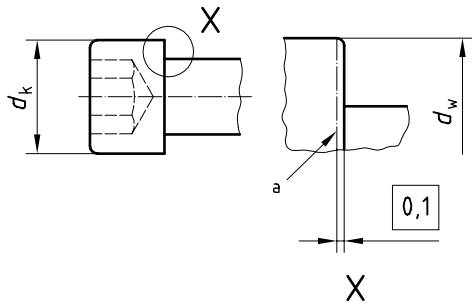
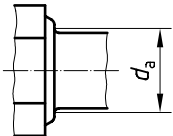
Feature	Tolerance for product grades			Notes
	A	B	C	
3.1.3.1.2 Width across corners  Figure 3	$e_{\min} = 1,13 s_{\min}$ $e_{\min} = 1,12 s_{\min}$ for bolts and screws with flange and other cold forged heads without trimming operation			
 Figure 4	$e_{\min} = 1,3 s_{\min}$			
3.1.3.1.3 Height of head  Figure 5	js14	js15	k	Tolerance
			< 10 ≥ 10	js16 js17

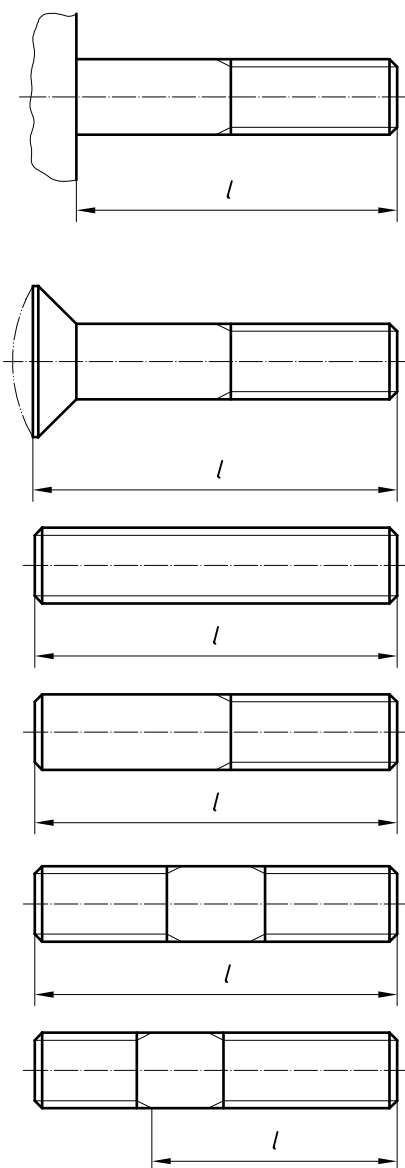
Feature	Tolerance for product grades			Notes
	A	B	C	
 Figure 6	For hexagon bolts and screws with flange, k is defined only as a maximum			
3.1.3.1.4 Wrenching height  Figure 7	$k_w^a \min = 0,7 k_{\min}$			k_w defines the length over which $e_{\min}$ applies but excluding any chamfer, washer face or radius specified in the appropriate product standard. The formulae for $k_w \min$ only apply to the products illustrated. ^a The symbol k_w replaces the previously used k'.
 Figure 8	$k_w^b \min = 0,7 \left[(k_{\max} - IT15) - \left(x + \frac{d_w \min - e_{\min}}{2} \tan \delta_{\max} \right) \right]$ x is the greater of $c_{\min} \times 1,25$ or $c_{\min} + 0,4$ δ is the flange angle Dimensions k_w^a, k, d_w, e and δ are in accordance with ISO 225.  Figure 8 a)			^b For gauging, see annex A of the product standards

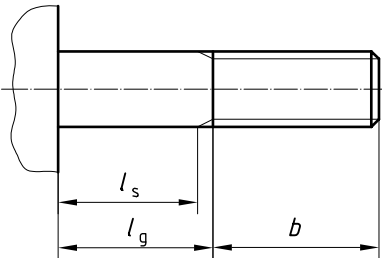
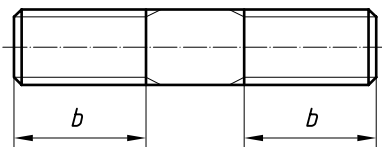
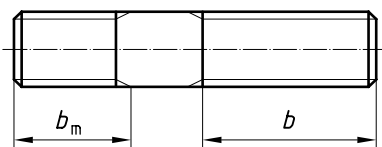
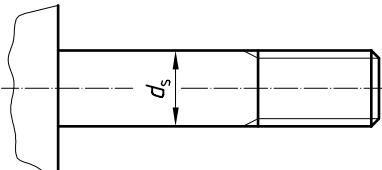
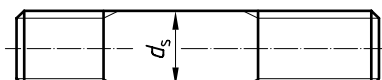
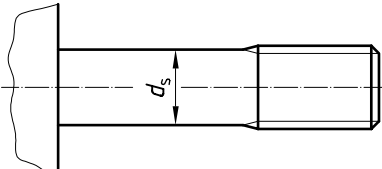
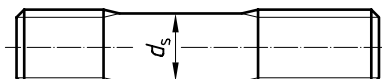
Feature	Tolerance for product grades			Notes
	A	B	C	
3.1.3.2 Internal				
3.1.3.2.1 Hexagon sockets				
 Figure 9	$e_{\min} = 1,14 s_{\min}$			
	s	Tolerance		
	0,7	EF8		
	0,9	JS9		
	1,3	K9		
	1,5	D11		
	2			
	2,5			
	3			
	4	E11		
5	E12			
6				
8				
10				
12				
14				
> 14	D12			
3.1.3.2.2 Slots				
 Figure 10	n	Tolerance		
	≤ 1	+ 0,20 + 0,06		
	$> 1 \leq 3$	+ 0,31 + 0,06		
	$> 3 \leq 6$	+ 0,37 + 0,07		

Feature	Tolerance for product grades			Notes
	A	B	C	
3.1.3.2.3 Depth of hexagon sockets and slots  Figure 11	The depth of hexagon sockets and slots is specified in product standards only as a minimum. It is restricted by the minimum wall thickness w.	—	—	For the time being generally applicable tolerances cannot be specified.
3.1.3.2.4 Cross recesses	See ISO 4757 for all dimensions except penetration depths. For penetration depths see appropriate product standard.			
3.1.3.2.5 Hexalobular recesses	See ISO 10664 for all dimensions except penetration depths. For penetration depths see appropriate product standard.			
3.1.4 Other features 3.1.4.1 Head diameter  Figure 12	h13 ^a	—	—	^a $\pm IT13$ for knurled heads
 Figure 13	h14	—	—	Combined control of diameter and height for counter-sunk head screws in accordance with ISO 7721 or ISO 10642.

Feature	Tolerance for product grades			Notes
	A	B	C	
3.1.4.2 Head height (except for hexagon heads)  Figure 14	$\leq M5: h13$ $> M5: h14$	—	—	
 Figure 15	For countersunk head screws k is defined in product standards only as a maximum.			Combined control of diameter and height for countersunk head screws in accordance with ISO 7721 or ISO 10642.
3.1.4.3 Bearing face diameter and height of washer-faced portion  Figure 16	$d_{w \min} = s_{\min} - IT16$ for width across flats < 21 mm $d_{w \min} = 0,95 s_{\min}$ for width across flats ≥ 21 mm $d_{w \max} = s_{\text{actual}}$			For product grade C a washer face is not mandatory.
	Thread diameter	min.	max.	
	$\geq 1,6$ to $2,5$	0,10	0,25	
	$> 2,5$ to 4	0,15	0,40	
	> 4 to 6	0,15	0,50	
	> 6 to 14	0,15	0,60	
	> 14 to 36	0,20	0,80	
	> 36	0,30	1,0	

Feature	Tolerance for product grades			Notes																											
	A	B	C																												
 a Reference datum for d_w Figure 17	d_w is defined in product standards only as a minimum.																														
 a Reference datum for d_w Figure 18	<table><tr><th colspan="2">Thread diameter</th><th>d_w</th></tr><tr><th>></th><th>$\leq$</th><th>min.</th></tr><tr><td></td><td>2,5</td><td>$d_k \text{ min} - 0,14$</td></tr><tr><td>2,5</td><td>5</td><td>$d_k \text{ min} - 0,25$</td></tr><tr><td>5</td><td>10</td><td>$d_k \text{ min} - 0,4$</td></tr><tr><td>10</td><td>16</td><td>$d_k \text{ min} - 0,5$</td></tr><tr><td>16</td><td>24</td><td>$d_k \text{ min} - 0,8$</td></tr><tr><td>24</td><td>36</td><td>$d_k \text{ min} - 1$</td></tr><tr><td>36</td><td>—</td><td>$d_k \text{ min} - 1,2$</td></tr></table>			Thread diameter		d_w	>	$\leq$	min.		2,5	$d_k \text{ min} - 0,14$	2,5	5	$d_k \text{ min} - 0,25$	5	10	$d_k \text{ min} - 0,4$	10	16	$d_k \text{ min} - 0,5$	16	24	$d_k \text{ min} - 0,8$	24	36	$d_k \text{ min} - 1$	36	—	$d_k \text{ min} - 1,2$	For product grade A only
Thread diameter		d_w																													
>	$\leq$	min.																													
	2,5	$d_k \text{ min} - 0,14$																													
2,5	5	$d_k \text{ min} - 0,25$																													
5	10	$d_k \text{ min} - 0,4$																													
10	16	$d_k \text{ min} - 0,5$																													
16	24	$d_k \text{ min} - 0,8$																													
24	36	$d_k \text{ min} - 1$																													
36	—	$d_k \text{ min} - 1,2$																													
 Figure 19	d_a for products without undercut is specified in ISO 885.			d_a for undercut products, see the appropriate product standard.																											

Feature	Tolerance for product grades			Notes
	A	B	C	
3.1.4.4 Length  Figure 20	js15	js17	$l \leq 150$: js17 $l > 150$: $\pm IT17$	

Feature	Tolerance for product grades			Notes
	A	B	C	
3.1.4.5 Thread length Bolt  Tie rod  Stud  Figure 21	$\begin{matrix} b + 2P \\ 0 \end{matrix}$	$\begin{matrix} b + 2P \\ 0 \end{matrix}$	$\begin{matrix} b + 2P \\ 0 \end{matrix}$	P is the pitch of thread. l_s is the minimum length of the unthreaded (plain) shank. l_g is the maximum length of the unthreaded shank (thread run-out included) and is therefore the minimum clamping length. Tolerance $+ 2 P$ related to dimension b applies only where l_s and l_g are not specified in the product standard. b_m refers to metal end of studs only.
3.1.4.6 Shank diameter     Figure 22	$\begin{matrix} h13 \end{matrix}$	$\begin{matrix} h14 \end{matrix}$	$\begin{matrix} \pm IT 15 \end{matrix}$	The tolerance is not applicable in the areas of the underhead fillet and thread run-out.
	Reduced shank diameter $\approx$ pitch diameter			

3.2 Geometrical tolerances

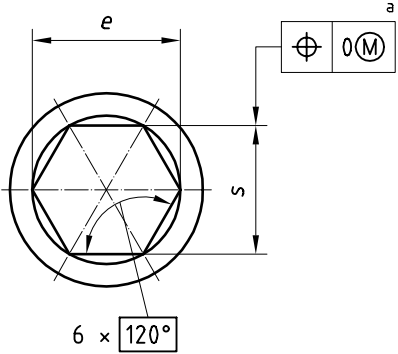
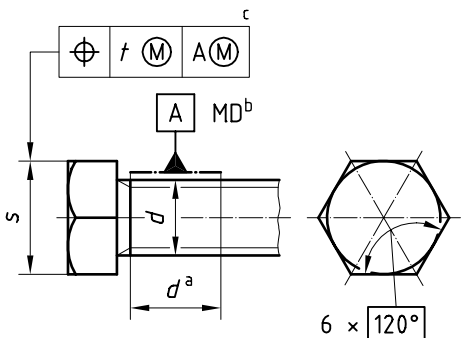
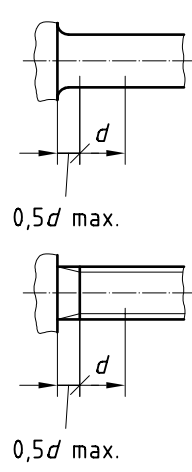
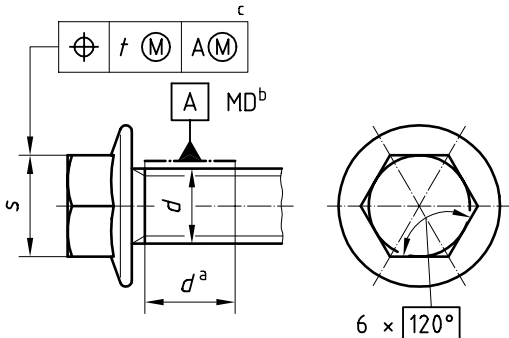
In accordance with ISO 1101 and ISO 2692 the tolerances specified in Figures 23 to 57 do not necessarily imply the use of any particular method of production, measurement or gauging.

When the pitch diameter axis is specified as the datum and the coaxiality deviation of the major diameter axis relative to the pitch diameter axis is negligible, e.g. normally with rolled threads, the major diameter axis may be taken as the datum.

According to ISO 1101 when the datum is the thread axis the letters MD indicate that the datum reference is the major diameter axis.

The maximum material principle in accordance with ISO 2692 is used.

Feature	Tolerance <i>t</i> for product grades			Notes
	A	B	C	
3.2.1 Driving feature 3.2.1.1 Tolerances of form 3.2.1.1.1 External 6 × 120° 0.05 (M) a a 3 × simultaneously. Figure 23 4 × 90° 0.05 (M) a a 2 × simultaneously. Figure 24				

Feature	Tolerance t for product grades			Tolerance t based on dimensions	Notes
	A	B	C		
3.2.1.1.2 Internal  a 3 × simultaneously. Figure 25					
3.2.1.2 Tolerances of position  a The datum A shall be as close to the head as possible but within $0,5d$ distance of the head and shall be either wholly plain or wholly threaded but shall not include the thread run-out or underhead fillet. b MD means that tolerance applies in relation to the axis of the cylinder derived from the major thread diameter. c 3 × simultaneously. Figure 26	2 IT13	2 IT14	2 IT15	s	 $0,5d$ max. $0,5d$ max.
 a, b, c See Figure 26. Figure 27	2 IT13	2 IT14	—	s	