इंटरनेट मानक

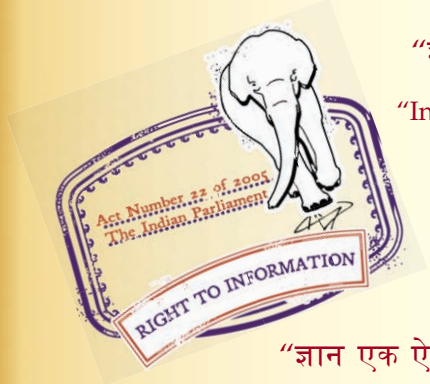
Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

"जानने का अधिकार, जीने का अधिकार"
Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पुराने को छोड नये के तरफ"
Jawaharlal Nehru
"Step Out From the Old to the New"

IS 1367-2 (2002): Technical Supply Conditions for Threaded Steel Fasteners, Part 2: Tolerances for Fasteners - Bolts, Screws, Studs and Nuts - Product Grades A, B and C [PGD 31: Bolts, Nuts and Fasteners Accessories]



"ज्ञान से एक नये भारत का निर्माण"
Satyanarayan Gangaram Pitroda
"Invent a New India Using Knowledge"

"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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IS 1367 (Part 2) : 2002
ISO 4759-1 : 2000
(Reaffirmed 2002)

भारतीय मानक

इस्पात के चूड़ीदार बंधकों के लिए तकनीकी पूर्ति शर्तें

भाग 2 बंधकों के लिए छूटें – काबले, पेंच, स्टड्स और ढिबरियाँ – उत्पाद ग्रेड ए, बी और सी

(तीसरा पुनरीक्षण)

Indian Standard

TECHNICAL SUPPLY CONDITIONS FOR THREADED STEEL FASTENERS

PART 2 TOLERANCES FOR FASTENERS — BOLTS, SCREWS, STUDS AND NUTS — PRODUCT GRADES A, B AND C

(Third Revision)

ICS 21.060.10

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

December 2002

Price Group 14

NATIONAL FOREWORD

This Indian Standard (Part 2) (Third Revision) which is identical with ISO 4759-1:2000 'Tolerances for fasteners—Part 1:Bolts, screws, studs and nuts—Product grades A, B and C' issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendation of the Bolts, Nuts and Fasteners Accessories Sectional Committee and approval of the Basic and Production Engineering Division Council.

This standard was originally published in 1961 and subsequently revised in 1967 and 1979. The last revision was based on ISO 4759/1-1978. This revision of the standard has been taken up to align it with ISO 4759-1:2000 by adoption under dual numbering system.

The text of ISO Standard has been approved as suitable for publication as Indian Standard without deviations. Certain terminology and conventions are, however, not identical to those used in Indian Standards. Attention is drawn especially to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards which are to be substituted in their place are listed below along with their degree of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
ISO 225 : 1983	IS 8536:1987 Fasteners—Bolts, screws, studs and nuts—Symbols and designation of dimensions (*first revision*)	Identical
ISO 286-1 : 1988	IS 919(Part 1):1993 ISO systems of limits and fits: Part 1 Basis of tolerances, deviations and fits (*second revision*)	do
ISO 286-2 : 1988	IS 919(Part 2):1993 ISO systems of limits and fits: Part 2 Tables of standard tolerance grades and limit deviations for holes and shafts (*second revision*)	do
ISO 885 : 2000	IS 4172:1987 Dimensions for radii under the head of bolts and screws (*first revision)*	Identical[1)]
ISO 965-3 : 1998	IS 14962(Part 3):2001 ISO General purpose metric screw threads—Tolerances : Part 3 Deviations for constructional screw threads	do
ISO 1101:2000	IS 8000(Part1):1985 Geometrical tolerancing on technical drawings: Part 1 Tolerances for form orientation, location and run-out and appropriate geometrical definitions (*first revision)*	Identical[2)]

(*Continued on third cover*)

[1)] Identical with ISO 885 : 1976.
[2)] Identical with ISO 1101 : 1983

Contents

Page

Indian Standard

TECHNICAL SUPPLY CONDITIONS FOR THREADED STEEL FASTENERS

PART 2 TOLERANCES FOR FASTENERS — BOLTS, SCREWS, STUDS AND NUTS — PRODUCT GRADES A, B AND C

(Third Revision)

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

Symbols and designations of dimensions are specified in ISO 225.

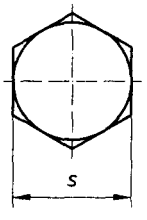
<table>
<tr><th rowspan="2">Feature</th><th colspan="4">Tolerance for product grades</th><th rowspan="2">Notes</th></tr>
<tr><th colspan="2">A</th><th>B</th><th>C</th></tr>
<tr><td>3.1.1 Tolerance level</td><td colspan="2"></td><td></td><td></td><td></td></tr>
<tr><td>Shank and bearing surface</td><td colspan="2">close</td><td>close</td><td>wide</td><td></td></tr>
<tr><td>Other features</td><td colspan="2">close</td><td>wide</td><td>wide</td><td></td></tr>
<tr><td>3.1.2 External thread</td><td colspan="2">6g</td><td>6g</td><td>8g
(but 6g for property class 8.8 and higher)</td><td>For certain products and coatings, other tolerance classes for threads may be specified in the relevant product and coating standards.</td></tr>
<tr><td>3.1.3 Driving features
3.1.3.1 External
3.1.3.1.1 Width across flats
 

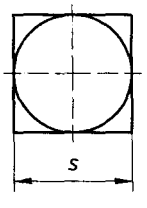
Figure 1
 

Figure 2</td><td colspan="2">s | Tolerance
⩽ 30 | h13
> 30 | h14</td><td colspan="2">s | Tolerance
⩽ 18 | h14
> 18 ⩽ 60 | h15
> 60 ⩽ 180 | h16
> 180 | h17</td><td></td></tr>
</table>

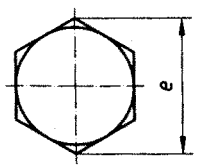
<table>
<tr><th rowspan="2">Feature</th><th colspan="3">Tolerance for product grades</th><th rowspan="2">Notes</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>3.1.3.1.2 Width across corners
 

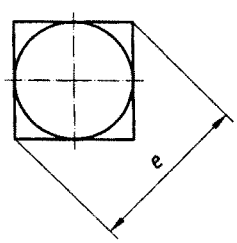
Figure 3</td><td colspan="3">$e_{min} = 1{,}13\ s_{min}$
$e_{min} = 1{,}12\ s_{min}$ for bolts and screws with flange and other cold forged heads without trimming operation</td><td></td></tr>
<tr><td> 

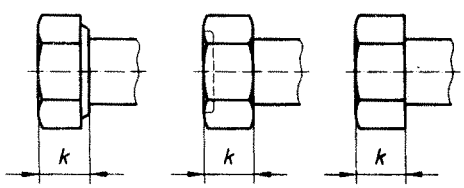
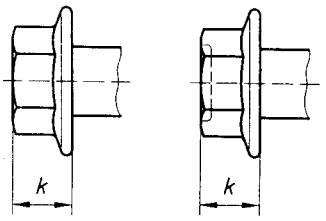
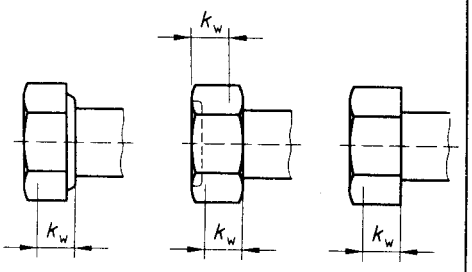
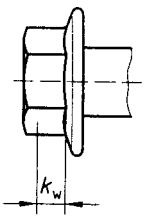
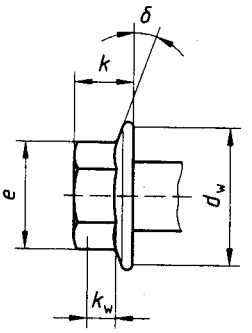
Figure 4</td><td colspan="3">$e_{min} = 1{,}3\ s_{min}$</td><td></td></tr>
<tr><td rowspan="3">3.1.3.1.3 Height of head
 

Figure 5</td><td rowspan="3">js14</td><td rowspan="3">js15</td><td>k</td><td>Tolerance</td><td rowspan="3"></td></tr>
<tr><td>< 10</td><td>js16</td></tr>
<tr><td>⩾ 10</td><td>js17</td></tr>
</table>

Feature	Tolerance for product grades A | B | C	Notes
 **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**	$k^{b}_{w\,min} = 0{,}7\left[(k_{max} - IT15) - \left(x + \frac{d_{w\,min} - e_{min}}{2}\tan\delta_{max}\right)\right]$ 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

<table>
<tr><th rowspan="2">Feature</th><th colspan="3">Tolerance for product grades</th><th rowspan="2">Notes</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>3.1.3.2 Internal

3.1.3.2.1 Hexagon sockets

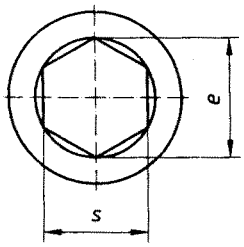
 

Figure 9</td><td>$e_{min} = 1{,}14\ s_{min}$

s | Tolerance
0,7 | EF8
0,9 | JS9
1,3 | K9
1,5; 2; 2,5; 3 | D11
4 | E11
5; 6; 8; 10; 12; 14 | E12
> 14 | D12</td><td>—</td><td>—</td><td></td></tr>
<tr><td>3.1.3.2.2 Slots

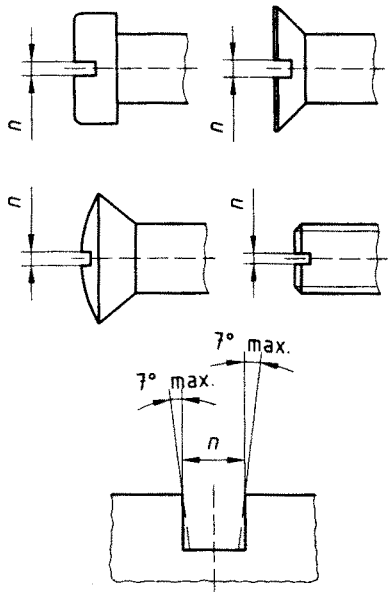
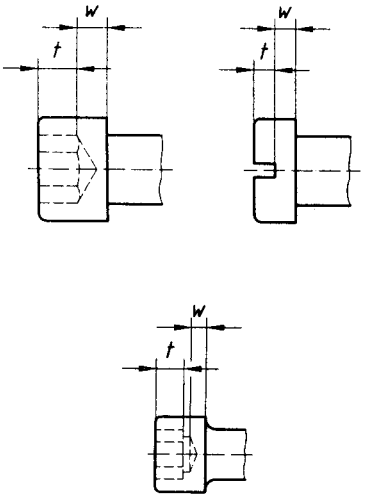
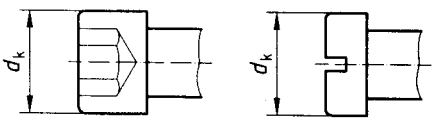
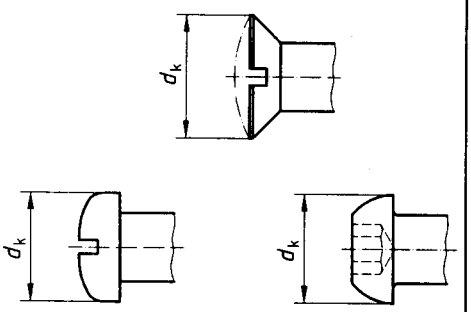
 

Figure 10</td><td>n | Tolerance
$\leqslant 1$ | + 0,20; + 0,06
$> 1 \leqslant 3$ | + 0,31; + 0,06
$> 3 \leqslant 6$ | + 0,37; + 0,07</td><td>—</td><td>—</td><td>Tolerance field
C13 for $n \leqslant 1$

C14 for $n > 1$</td></tr>
</table>

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] ± IT13 for knurled heads
 **Figure 13**	h14	—	—	Combined control of diameter and height for countersunk head screws in accordance with ISO 7721 or ISO 10642.

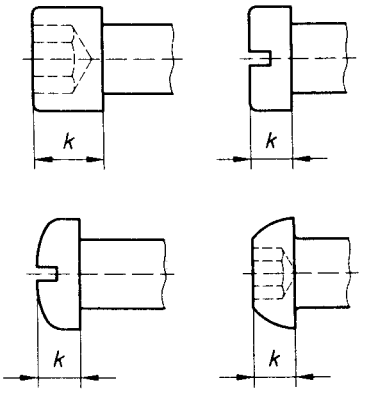
<table>
<tr><th rowspan="2">Feature</th><th colspan="3">Tolerance for product grades</th><th rowspan="2">Notes</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>3.1.4.2 Head height (except for hexagon heads)
 

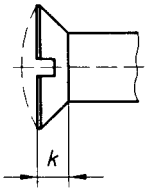
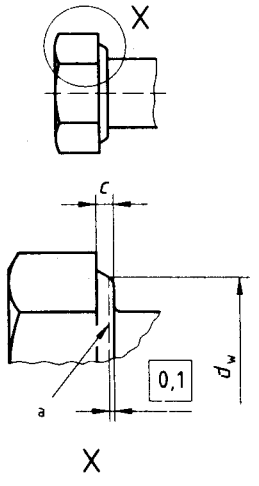
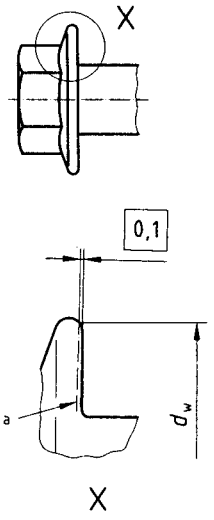
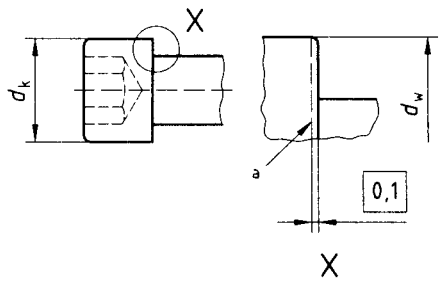
Figure 14</td><td>≤ M5: h13
> M5: h14</td><td>—</td><td>—</td><td></td></tr>
<tr><td> 

Figure 15</td><td colspan="3">For countersunk head screws k is definied in product standards only as a maximum.</td><td>Combined control of diameter and height for countersunk head screws in accordance with ISO 7721 or ISO 10642.</td></tr>
<tr><td>3.1.4.3 Bearing face diameter and height of washer-faced portion
 

a Reference datum for d_w
Figure 16</td><td colspan="3">$d_{w\,min} = s_{min}$ – IT16 for width across flats < 21 mm
$d_{w\,min} = 0{,}95\ s_{min}$ for width across flats ≥ 21 mm
$d_{w\,max} = s_{actual}$
<table><tr><th rowspan="2">Thread diameter</th><th colspan="2">c</th></tr><tr><th>min.</th><th>max.</th></tr><tr><td>≥ 1,6 to 2,5</td><td>0,10</td><td>0,25</td></tr><tr><td>> 2,5 to 4</td><td>0,15</td><td>0,40</td></tr><tr><td>> 4 to 6</td><td>0,15</td><td>0,50</td></tr><tr><td>> 6 to 14</td><td>0,15</td><td>0,60</td></tr><tr><td>> 14 to 36</td><td>0,20</td><td>0,80</td></tr><tr><td>> 36</td><td>0,30</td><td>1,0</td></tr></table></td><td>For product grade C a washer face is not mandatory.</td></tr>
</table>

<table>
<tr><th>Feature</th><th colspan="3">Tolerance for product grades
A | B | C</th><th>Notes</th></tr>
<tr><td> 

a Reference datum for d_w
Figure 17</td><td colspan="3">d_w is defined in product standards only as a minimum.</td><td></td></tr>
<tr><td> 

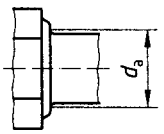
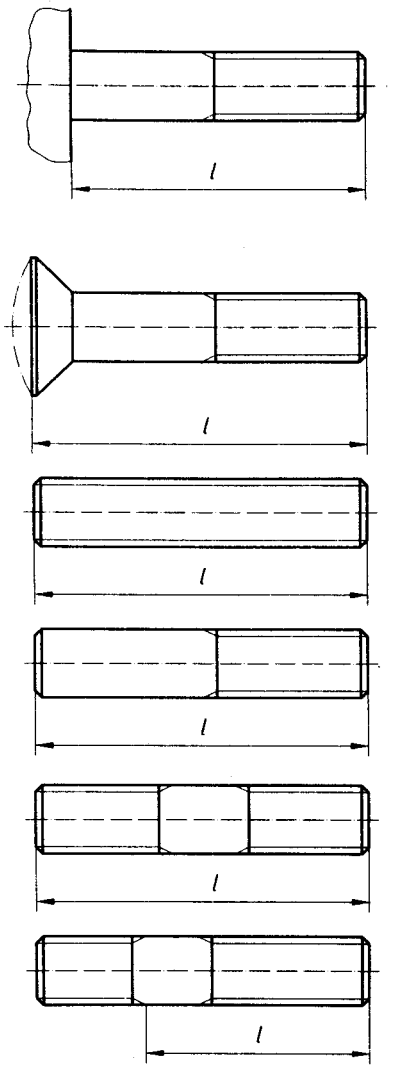
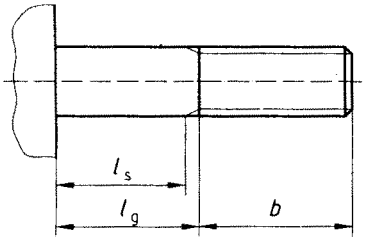
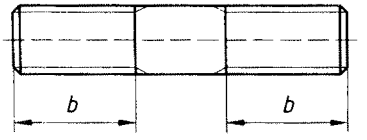
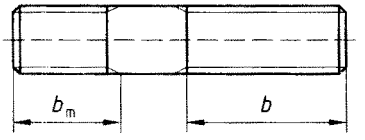
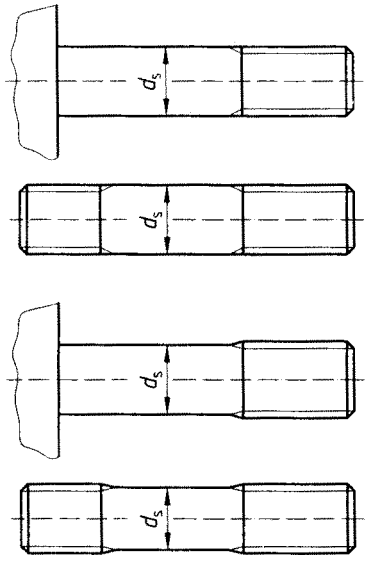
a Reference datum for d_w
Figure 18</td><td colspan="3"><table>
<tr><th colspan="2">Thread diameter</th><th>d_w</th></tr>
<tr><th>></th><th>≤</th><th>min.</th></tr>
<tr><td></td><td>2,5</td><td>$d_{k\,min} - 0,14$</td></tr>
<tr><td>2,5</td><td>5</td><td>$d_{k\,min} - 0,25$</td></tr>
<tr><td>5</td><td>10</td><td>$d_{k\,min} - 0,4$</td></tr>
<tr><td>10</td><td>16</td><td>$d_{k\,min} - 0,5$</td></tr>
<tr><td>16</td><td>24</td><td>$d_{k\,min} - 0,8$</td></tr>
<tr><td>24</td><td>36</td><td>$d_{k\,min} - 1$</td></tr>
<tr><td>36</td><td>—</td><td>$d_{k\,min} - 1,2$</td></tr>
</table></td><td>For product grade A only</td></tr>
<tr><td> 

Figure 19</td><td colspan="3">d_a for products without undercut is specified in ISO 885.</td><td>d_a for undercut products, see the appropriate product standard.</td></tr>
</table>

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

Feature	Tolerance for product grades			Notes
	A	B	C	
3.1.4.5 Thread length **Bolt**  **Tie rod**  **Stud**  **Figure 21**	b^{+2P}_{0} b^{+2P}_{0} b^{+2P}_{0} b_m js16	b^{+2P}_{0} b^{+2P}_{0} b^{+2P}_{0} b_m js17	b^{+2P}_{0} b^{+2P}_{0} b^{+2P}_{0} b_m js17	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**	h13	h14	± IT 15	The tolerance is not applicable in the areas of the underhead fillet and thread run-out.
	Reduced shank diameter ≈ pitch diameter			

3.2 Geometrical tolerances

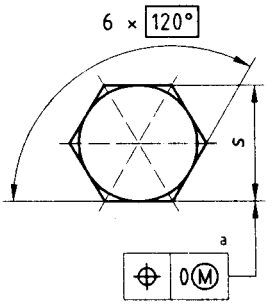
In accordance with ISO 1101 and ISO 2692 the tolerances specified in Figures 23 to 57 do not necessarily imply the use of any particular method of production, measurement or gauging.

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.

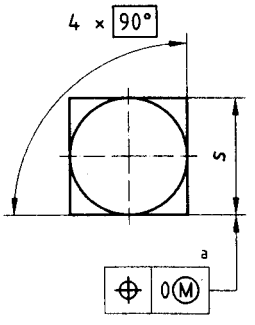
The maximum material principle in accordance with ISO 2692 is used.

Feature	Tolerance *t* 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				



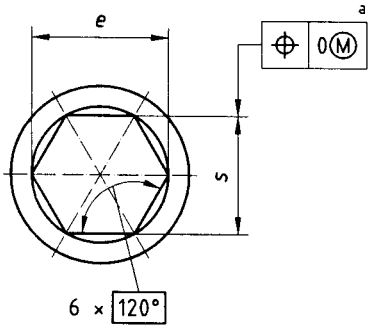
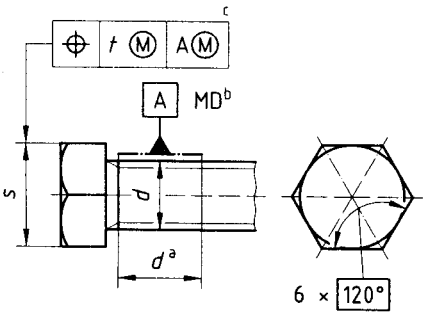
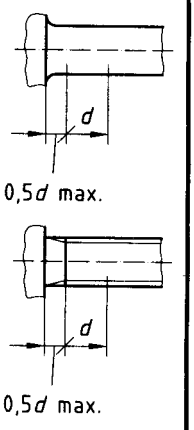
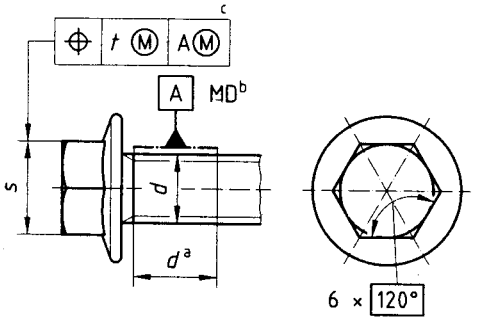
a 3 × simultaneously.

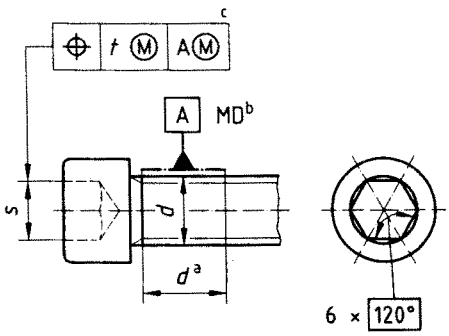
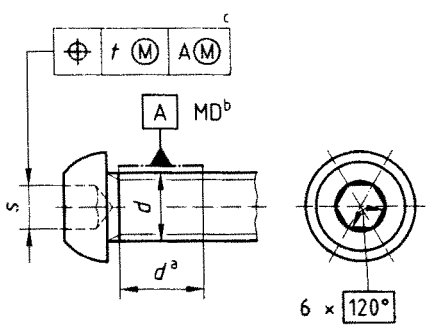
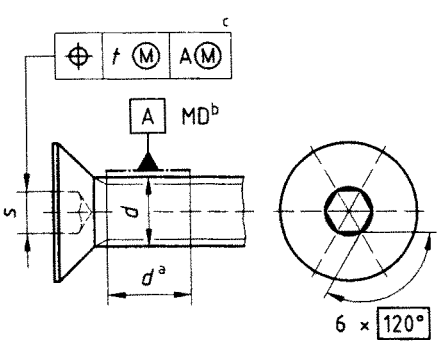
Figure 23

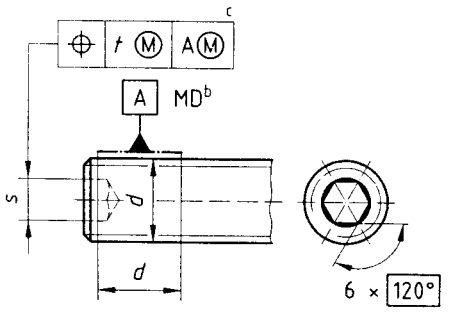
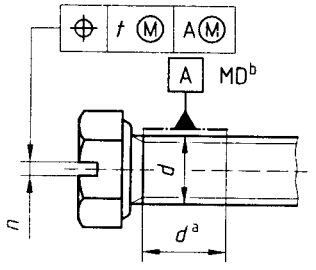
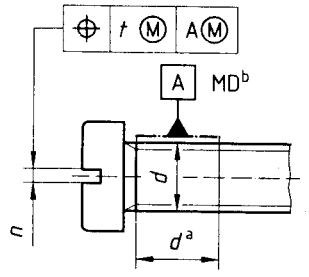
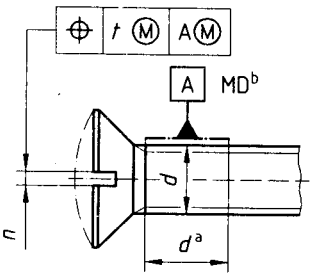


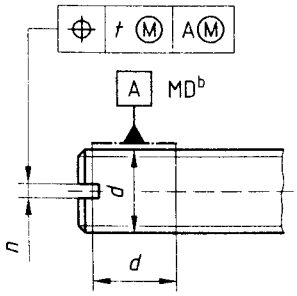
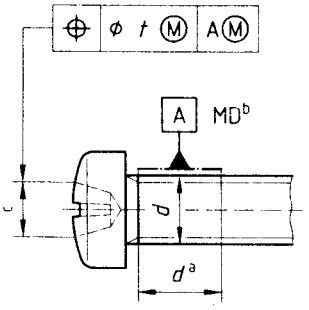
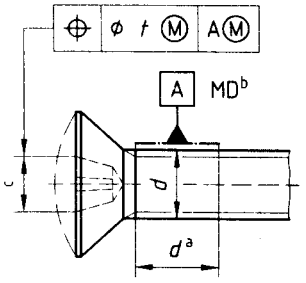
a 2 × simultaneously.

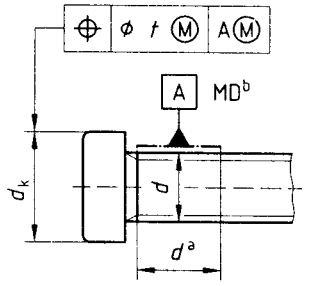
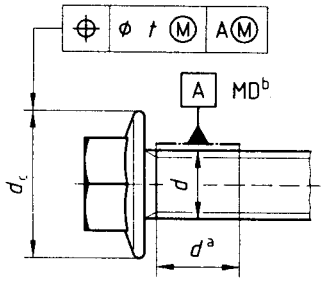
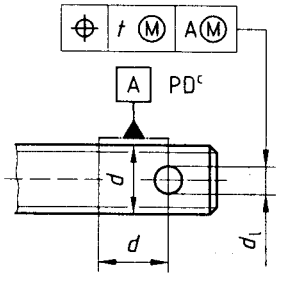
Figure 24

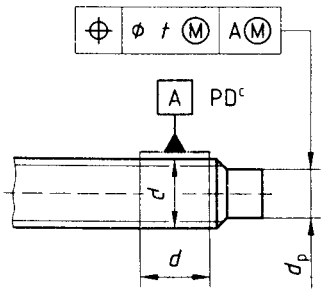
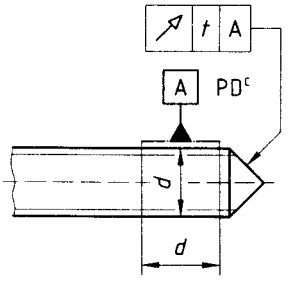
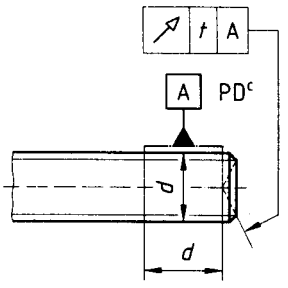
Feature	Tolerance t for product grades A	B	C	Tolerance t based on dimensions	Notes
3.2.1.1.2 Internal  a 3 × simultaneously. **Figure 25**					
3.2.1.2 Tolerances of position  a The datum A shall be as close to the head as possible but within 0,5d distance of the head and shall be either wholly plain 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	
 a, b, c See Figure 26. **Figure 27**	2 IT13	2 IT14	—	s	

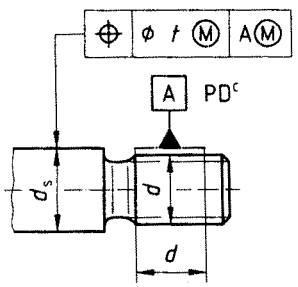
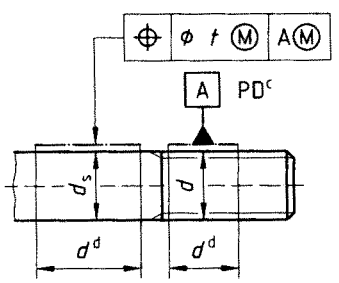
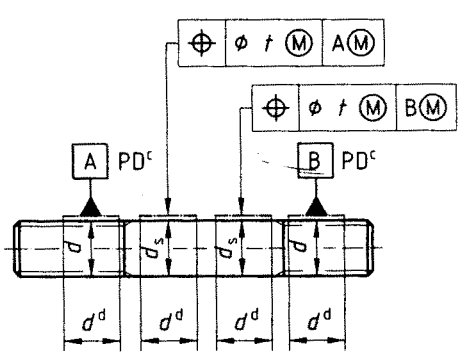
Feature	Tolerance t for product grades			Tolerance t based on dimensions	Notes
	A	B	C		
 a, b, c See Figure 26 **Figure 28**	2 IT13	—	—	d	
 a, b, c See Figure 26. **Figure 29**	2 IT13	—	—	d	
 a, b, c See Figure 26. **Figure 30**	2 IT13	—	—	d	

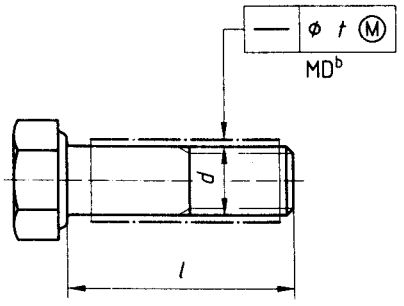
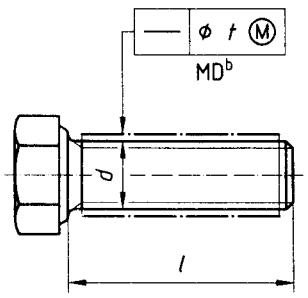
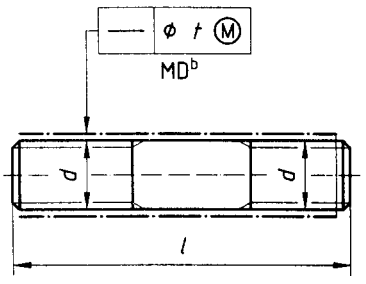
Feature	Tolerance t for product grades			Tolerance t based on dimensions	Notes
	A	B	C		
 b, c See Figure 26. **Figure 31**	2 IT12	—	—	d	
 a, b See Figure 26 **Figure 32**	2 IT12	2 IT13	2 IT14	d	
 a, b See Figure 26. **Figure 33**	2 IT12	2 IT13	2 IT14	d	
 a, b See Figure 26. **Figure 34**	2 IT12	2 IT13	2 IT14	d	

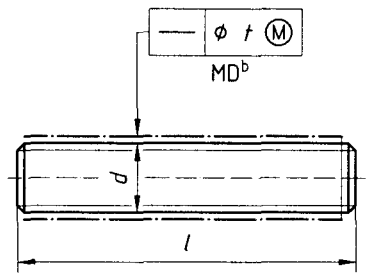
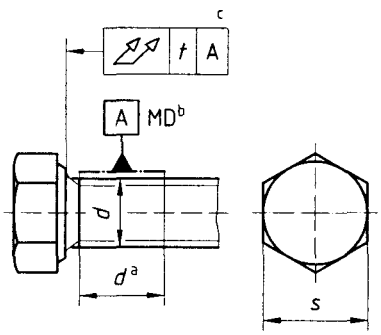
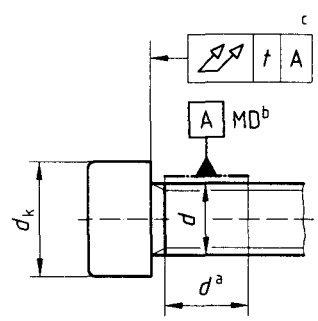
Feature	Tolerance t for product grades			Tolerance t based on dimensions	Notes
	A	B	C		
	2 IT12	—	—	d	
b See Figure 26.					
Figure 35					
	2 IT13	—	—	d	
a, b See Figure 26.					
c For referee purposes coaxiality of cross recess shall be assessed by means of a penetration gauge point in accordance with ISO 4757.					
Figure 36					
	2 IT13	—	—	d	
a, b See Figure 26.					
c See Figure 36.					
Figure 37					

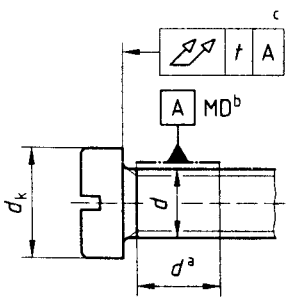
Feature	Tolerance t for product grades			Tolerance t based on dimensions	Notes
	A	B	C		
3.2.2 Other features					
3.2.2.1 Tolerances of position and run-out					
	2 IT13	2 IT14	2 IT15	d_k	
a, b See Figure 26.					
Figure 38					
	2 IT13	2 IT14	—	d_c	
a, b See Figure 26.					
Figure 39					
	2 IT13	2 IT14	2 IT15	d	
c PD means that the tolerance applies in relation to the axis derived from the pitch diameter.					
Figure 40					

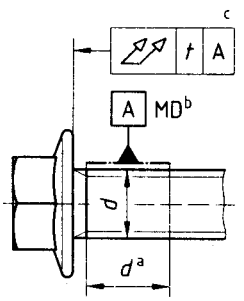
Feature	Tolerance t for product grades			Tolerance t based on dimensions	Notes
	A	B	C		
 [c] See Figure 40. **Figure 41**	IT13 [d] 2 IT13 [e]	—	—	d	[d] For set screws. [e] For all other products.
 [c] See Figure 40. **Figure 42**	IT13	—	—	d	
 [c] See Figure 40. **Figure 43**	IT13	—	—	d	

Feature	Tolerance t for product grades			Tolerance t based on dimensions	Notes
	A	B	C		
	2 IT13	2 IT14	2 IT15	d	
c See Figure 40.					
Figure 44					
	IT13	IT14	IT15	d	
c See Figure 40. d The gauge datum feature A shall be as close to the respective part of the shank as possible but shall avoid the thread run-out.					
Figure 45					
	IT13	IT14	—	d	
c See Figure 40. d The gauge datum features A and B shall be as close to the respective part of the shank as possible but shall avoid the thread run-out.					
Figure 46					

Feature	Tolerance t for product grades			Tolerance t based on dimensions	Notes
	A	B	C		
3.2.2.2 Tolerances of straightness					
	d		$d \leqslant 8$: $t = 2(0{,}002l + 0{,}05)$ $d > 8$: $t = 2(0{,}002\,5l + 0{,}05)$		
	$\leqslant 8$	$t = 0{,}002l + 0{,}05$			
	> 8	$t = 0{,}002\,5l + 0{,}05$			
b See Figure 26.					
Figure 47					
	d		$d \leqslant 8$: $t = 2(0{,}002l + 0{,}05)$ $d > 8$: $t = 2(0{,}002\,5l + 0{,}05)$		
	$\leqslant 8$	$t = 0{,}002l + 0{,}05$			
	> 8	$t = 0{,}002\,5l + 0{,}05$			
b See Figure 26.					
Figure 48					
	d		—		
	$\leqslant 8$	$t = 0{,}002l + 0{,}05$			
	> 8	$t = 0{,}002\,5l + 0{,}05$			
b See Figure 26.					
Figure 49					

Feature	Tolerance t for product grades A	B	C	Tolerance t based on dimension d	Notes
 b See Figure 26. **Figure 50**			$d \leqslant 8$: $t = 2(0{,}002l + 0{,}05)$ $d > 8$: $t = 2(0{,}002\,5l + 0{,}05)$		
3.2.2.3 Tolerance of total run-out  a, b See Figure 26. c Up to 0,8s diameter only. **Figure 51**	0,04		—	1,6	For product grades A and B tolerance t is calculated as follows: $\leqslant$ M 39: $t = 1{,}2\,d \cdot \tan 1°$ > M 39: $t = 1{,}2\,d \cdot \tan 0{,}5°$ For product grade C tolerance t is twice as much.
				2	
	0,08			2,5	
				3	
				3,5	
				4	
	0,15		0,3	5	
				6	
				7	
 a, b See Figure 26. c Up to 0,8 d_k diameter only. **Figure 52**	0,17		0,34	8	
	0,21		0,42	10	
	0,25		0,50	12	
	0,29		0,58	14	
	0,34		0,68	16	
	0,38		0,76	18	
	0,42		0,84	20	
	0,46		0,92	22	
	0,50		1,00	24	
	0,57		1,14	27	
	0,63		1,26	30	
	0,69		1,38	33	
	0,76		1,52	36	
	0,82		1,64	39	
	0,44		0,88	42	
	0,47		0,94	45	
	0,50		1	48	
	0,55		1,1	52	

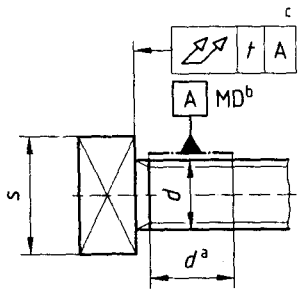
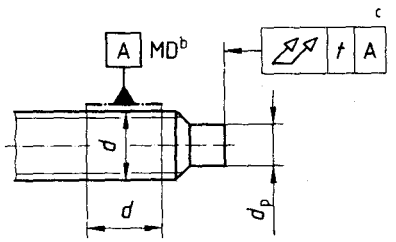
Feature	Tolerance t for product grades			Tolerance t based on dimension d	Notes
	A	B	C		
	0,04		—	1,6	
				2	
	0,08		0,3	2,5	
				3	
				3,5	
				4	
	0,15			5	
				6	
				7	
a, b See Figure 26. c Up to 0,8 d_k diameter only. **Figure 53**	0,17		0,34	8	
	0,21		0,42	10	See Figures 51 and 52
	0,25		0,50	12	
	0,29		0,58	14	
	0,34		0,68	16	In case of flange bolts, tolerances apply to type F and type U.
	0,38		0,76	18	
	0,42		0,84	20	
	0,46		0,92	22	
	0,50		1,00	24	
	0,57		1,14	27	
	0,63		1,26	30	
	0,69		1,38	33	
	0,76		1,52	36	
	0,82		1,64	39	
	0,44		0,88	42	
	0,47		0,94	45	
	0,50		1	48	
	0,55		1,1	52	

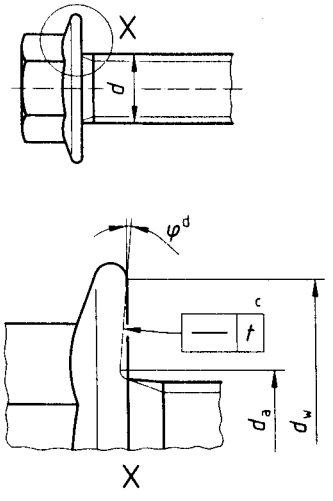


a, b See Figure 26.

c Line of highest points on any radial line.

Figure 54

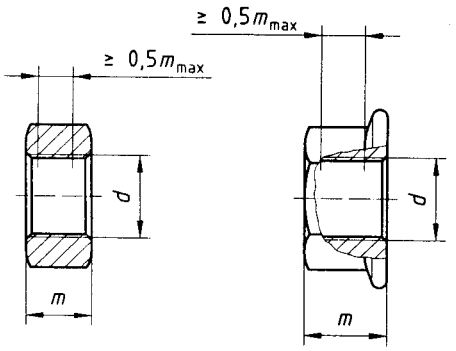
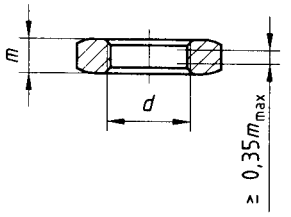
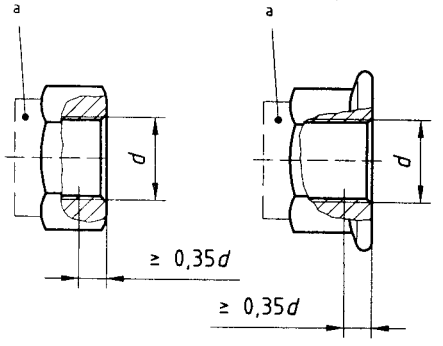
Feature	Tolerance t for product grades			Tolerance t based on dimensions	Notes
	A	B	C		
 [a, b] See Figure 26. [c] See Figure 51. **Figure 55**	For t see Figures 51 to 54			Basis for t see Figures 51 to 54	
 [a, b] See Figure 26. [c] Up to ∅ 0,8d_p only **Figure 56**					For dog points only, not for pilot points

Feature	Tolerance t for product grades			Tolerance t based on dimensions	Notes
	A	B	C		
3.2.2.4 Permissible deviation from the form of bearing face  c radial lines between $d_{a\,max}$ and $d_{w\,min}$. d According to product standard. **Figure 57**	0,005 d			d	

4 Tolerances for metric nuts

4.1 Dimensional tolerances

NOTE Symbols and designations of dimensions are specified in ISO 225.

Feature	Tolerance for product grades			Notes
	A	B	C	
4.1.1 Tolerance level				
Bearing surface	close	close	wide	
Other features	close	wide	wide	
4.1.2 Internal thread	6H	6H	7H	For certain products and coatings, other tolerance classes may be specified in the relevant product and coating standards.
	For all nuts of heights $m \geq 0{,}8d$ the minor diameter shall be within the specified tolerances for a minimum of 0,5 m_{max} (only for sizes ≥ M3).			
	For all nuts of heights $0{,}5d \leq m < 0{,}8d$ the minor diameter shall be within the specified tolerances for a minimum of 0,35 m_{max}			
	For prevailing torque type nuts the minor diameter may exceed the specified tolerance for a maximum height of 0,35d from the non-restricted end which does not contain the prevailing torque feature.			

a Profile varies for different types of prevailing torque type nuts.

Figure 58

<table>
<tr><th rowspan="2">Feature</th><th colspan="3">Tolerance for product grades</th><th rowspan="2">Notes</th></tr>
<tr><th colspan="2">A</th><th>B</th><th>C</th></tr>
<tr><td>4.1.3 Driving features

4.1.3.1 Width across flats

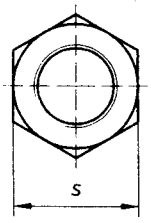
 

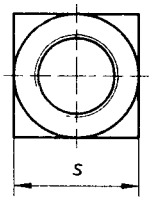
Figure 59</td><td>s</td><td>Toler-ance</td><td>s</td><td>Tolerance</td><td></td></tr>
<tr><td></td><td>$\leqslant 30$
> 30</td><td>h13
h14</td><td>$\leqslant 18$
$> 18 \leqslant 60$
$> 60 \leqslant 180$
> 180</td><td>h14
h15
h16
h17</td><td></td></tr>
<tr><td> 

Figure 60</td><td colspan="2">See figure 59</td><td colspan="2">See figure 59</td><td></td></tr>
<tr><td>4.1.3.2 Width across corners

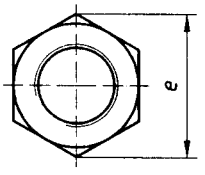
 

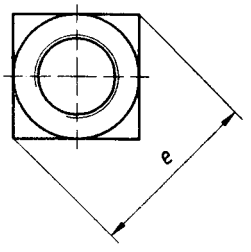
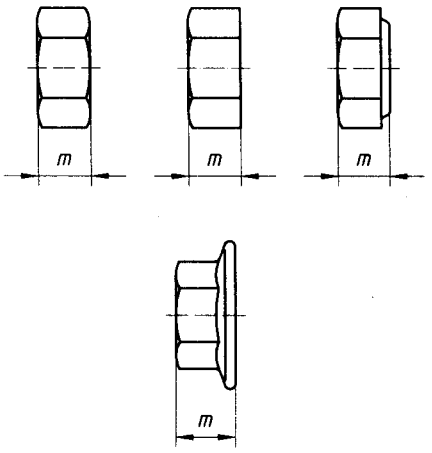
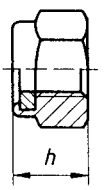
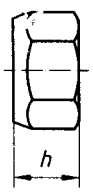
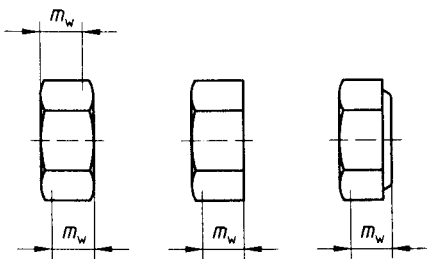
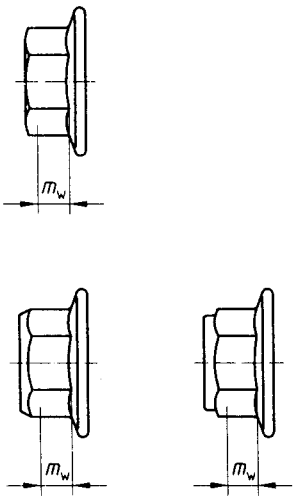
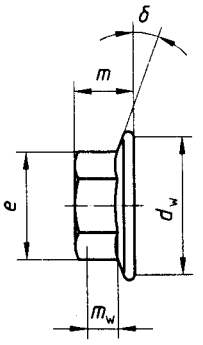
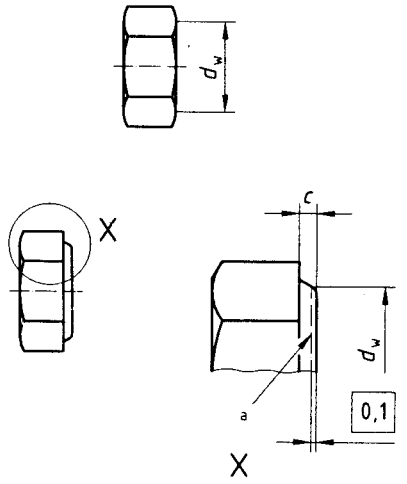
Figure 61</td><td colspan="4">$e_{min} = 1{,}13\ s_{min}$</td><td></td></tr>
<tr><td> 

Figure 62</td><td colspan="4">$e_{min} = 1{,}3\ s_{min}$</td><td></td></tr>
</table>

Feature	Tolerance for product grades A	B	C	Notes
4.1.4 Other features **4.1.4.1 Height of nuts**  **Figure 63**	$d \leqslant 12$ mm: h14 12 mm $< d \leqslant 18$ mm: h15 $d > 18$ mm: h16		h17	For slotted nuts and castle nuts see 4.1.5.1
Prevailing torque type nuts (with non-metallic insert)  Prevailing torque type all metal hexagon nuts  **Figure 64**	Tolerance of h, see product standards			

Feature	Tolerance for product grades A	B	C	Notes
4.1.4.2 Wrenching height  **Figure 65**	$m_{w\,min}^{a} = 0{,}8\ m_{min}$			m_w defines the length over which e_{min} applies but excluding any chamfer or washer face specified in the appropriate product standard. The symbol m_w replaces the previously used m'.
 **Figure 66**	$m_{w\,min}^{b} = 0{,}8 \times \left[m_{min} - \left(x + \frac{d_{w\,min} - e_{min}}{2} \tan\delta_{max} \right) \right]$ x is the greater of $c_{min} \times 1{,}25$ or $c_{min} + 0{,}4$ δ is the flange angle Dimensions m_w[a], m, d_w, e and δ are in accordance with ISO 225. 			[a] The formulae for $m_{w\,min}$ only apply to the products illustrated. [b] For gauging, see annex A of the product standards.

<table>
<tr><th>Feature</th><th colspan="3">Tolerance for product grades
A | B | C</th><th>Notes</th></tr>
<tr><td>4.1.4.3 Bearing face diameter and height of washer-faced portion
 

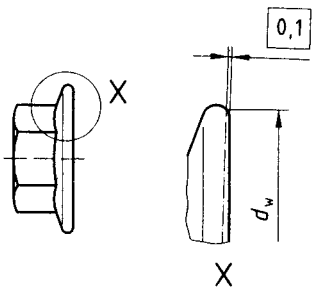
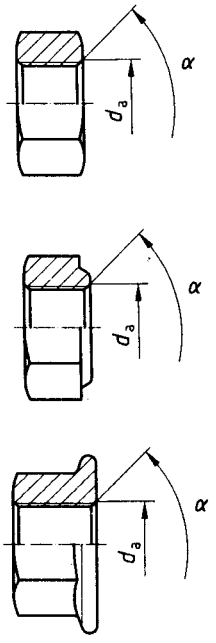
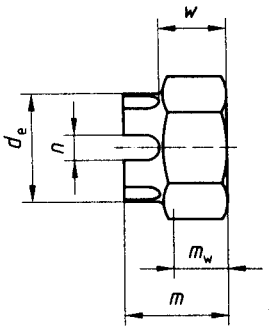
a Reference datum for d_w
Figure 67</td><td colspan="3">$d_{w\,min} = s_{min}$ – IT16 for width across flats < 21 mm
$d_{w\,min} = 0{,}95\ s_{min}$ for width across flats ⩾ 21 mm
$d_{w\,max} = s_{actual}$
<table><tr><th rowspan="2">Thread diameter</th><th colspan="2">c</th></tr><tr><th>min.</th><th>max.</th></tr><tr><td>⩾ 1,6 to 2,5</td><td>0,10</td><td>0,25</td></tr><tr><td>> 2,5 to 4</td><td>0,15</td><td>0,40</td></tr><tr><td>> 4 to 6</td><td>0,15</td><td>0,50</td></tr><tr><td>> 6 to 14</td><td>0,15</td><td>0,60</td></tr><tr><td>> 14 to 36</td><td>0,2</td><td>0,8</td></tr><tr><td>> 36</td><td>0,3</td><td>1,0</td></tr></table></td><td rowspan="2">Requirements apply to both sides of symmetrical parts.</td></tr>
<tr><td> 

Figure 68</td><td colspan="3">$d_{w\,min}$ for hexagon nuts with flange in accordance with product standards</td></tr>
</table>

Feature	Tolerance for product grades A	B	C	Notes
 α = 90° to 120° **Figure 69**	$d \leqslant 5$ mm : $d_{a\,max} = 1{,}15d$ 5 mm < $d \leqslant 8$ mm : $d_{a\,max} = d + 0{,}75$ $d > 8$ mm: $d_{a\,max} = 1{,}08d$ for all sizes: $d_{a\,min} = d$			Requirements apply to both sides of symmetrical parts.

4.1.5 Special products

4.1.5.1 Castle nuts, slotted nuts



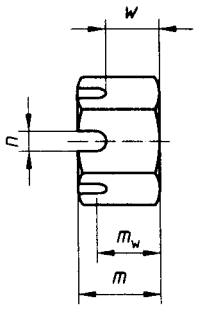


Figure 70

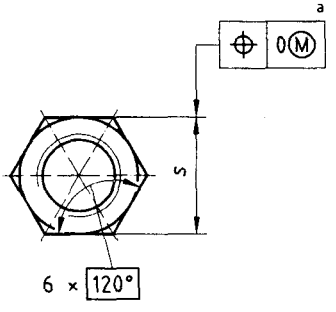
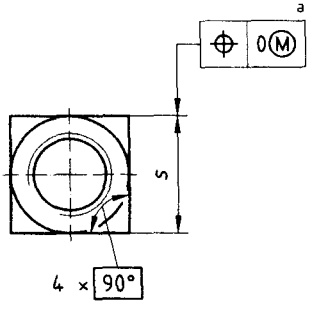
d_e	h14	h15	h16
m	h14	h15	h17
n	H14	H14	H15
w	h14	h15	h17
m_w	see m_w-values for hexagon nuts style 1 (see ISO 4032)		

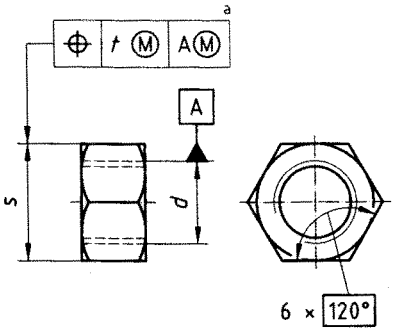
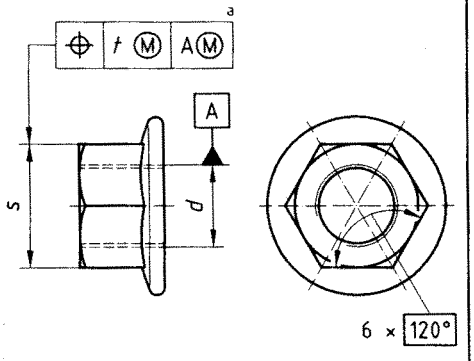
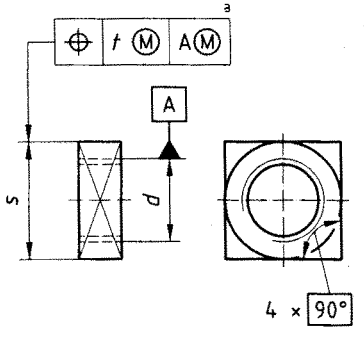
4.2 Geometrical tolerances

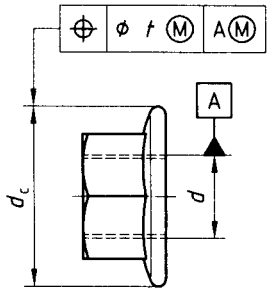
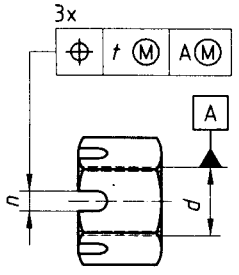
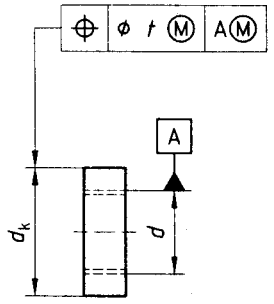
In accordance with ISO 1101 and ISO 2692 the tolerances specified in Figures 71 to 83 do not necessarily imply the use of any particular method of production, measurement or gauging.

Where the nut thread is used as the datum the pitch diameter shall be the reference diameter.

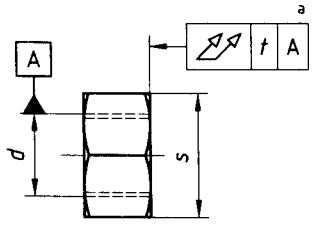
The maximum material principle in accordance with ISO 2692 is used.

Feature	Tolerance *t* for product grades			Notes
	A	B	C	
4.2.1 Driving features				
4.2.1.1 Tolerances of form				
				
a 3 × simultaneously.				
Figure 71				
				
a 2 × simultaneously.				
Figure 72				

Feature	Tolerance t for product grades			Tolerance t based on dimensions	Notes
	A	B	C		
4.2.1.2 Tolerances of position					
 a 3 × simultaneously. **Figure 73**	2 IT13	2 IT14	2 IT15	s	
 a 3 × simultaneously. **Figure 74**	2 IT13	2 IT14	—	s	
 a 2 × simultaneously. **Figure 75**	2 IT13	2 IT14	2 IT15	s	

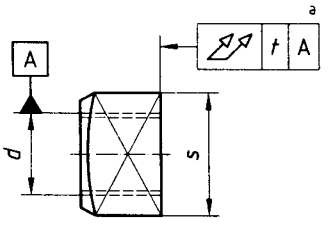
Feature	Tolerance t for product grades			Tolerance t based on dimensions	Notes
	A	B	C		
4.2.2 Other features					
4.2.2.1 Tolerances of position					
 **Figure 76**	2 IT14	2 IT15	—	d_c	
 **Figure 77**	2 IT13	2 IT14	2 IT15	d	
 **Figure 78**	2 IT13	2 IT14	—	d_k	

Feature	Tolerance t for product grades			Tolerance t based on dimension	Notes
	A	B	C	d	
4.2.2.2 Tolerance of total run-out	0,04			1,6	For symmetrical parts the perpendicularity requirement shall apply for both faces.
				2	
	0,08		—	2,5	
				3	
				3,5	
				4	
	0,15		0,3	5	
				6	
				7	
	0,17		0,34	8	
	0,21		0,42	10	
	0,25		0,50	12	
	0,29		0,58	14	
	0,34		0,68	16	
	0,38		0,76	18	
	0,42		0,84	20	
	0,46		0,92	22	
	0,50		1	24	
	0,57		1,14	27	
	0,63		1,26	30	
	0,69		1,38	33	
	0,76		1,52	36	
	0,82		1,64	39	
	0,44		0,88	42	
	0,47		0,94	45	
	0,50		1	48	
	0,55		1,1	52	



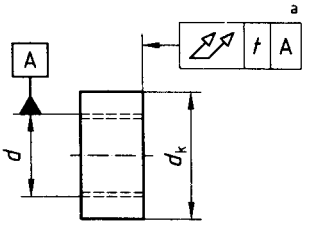
a Up to 0,8s diameter only.

Figure 79



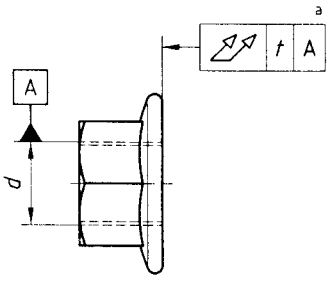
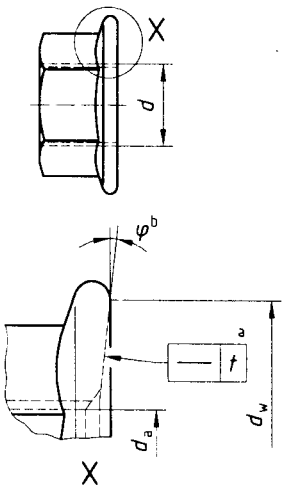
a Up to ∅ 0,8s only.

Figure 80



a Up to ∅ 0,8d_k only.

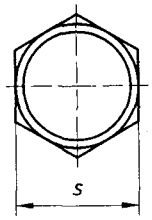
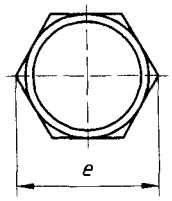
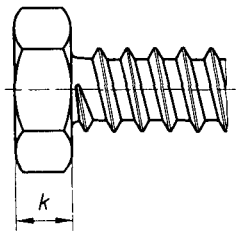
Figure 81

Feature	Tolerance t for product grades			Notes
	A	B	C	
 a Line of highest points on any radial line. **Figure 82**	For t see values for Figures 79, 80 and 81.			
4.2.2.3 Permissible deviation from the shape of bearing face  a Radial lines between $d_{a\,max}$ and $d_{w\,min}$. b According to product standard. **Figure 83**	0,005d			

5 Tolerances for tapping screws

5.1 Dimensional tolerances — Product grade A

Symbols and designations of dimensions are specified in ISO 225.

Feature	Tolerance	Notes
5.1.1 Thread	see ISO 1478	
5.1.2 Driving features **5.1.2.1 External** **5.1.2.1.1 Width across flats**  **Figure 84**	h13	
5.1.2.1.2 Width across corners  **Figure 85**	$e_{min} = 1{,}12\ s_{min}$	
5.1.2.1.3 Height of head  **Figure 86**	For tolerances see ISO 1479	For tapping screws with hexagon flange head and hexagon washer head see ISO 7053 and ISO 10509 respectively.

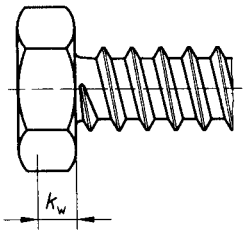
<table>
<tr><th>Feature</th><th>Tolerance</th><th>Notes</th></tr>
<tr><td>5.1.2.1.4 Wrenching height
 

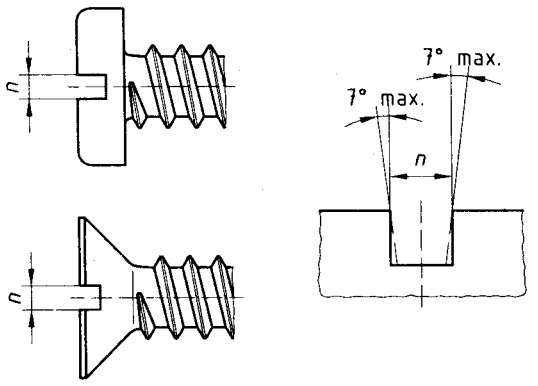
Figure 87</td><td>$k_{w\ min.} = 0{,}7\ k_{min}$</td><td>For tapping screws with hexagon flange head and hexagon washer head see ISO 7053 and ISO 10509 respectively.
The symbol k_w replaces the previously used k'.</td></tr>
<tr><td>5.1.2.2 Internal
5.1.2.2.1 Width of slots
 

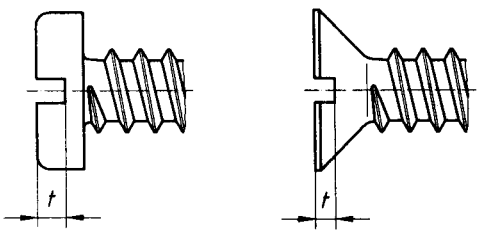
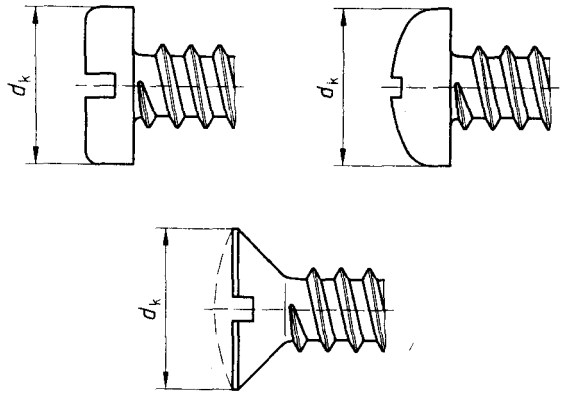
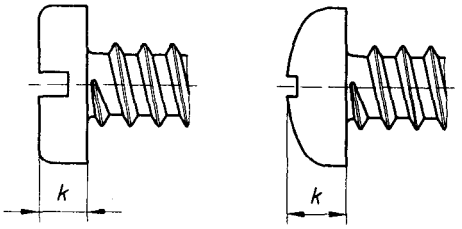
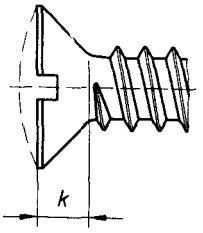
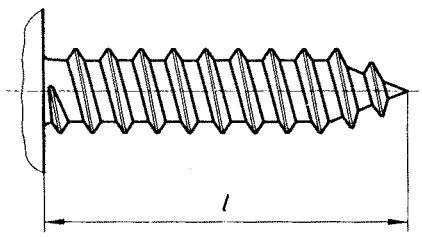
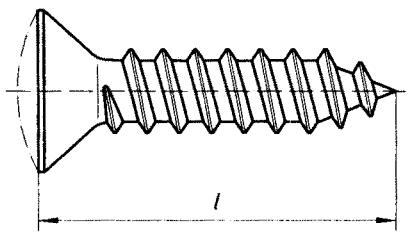
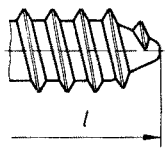
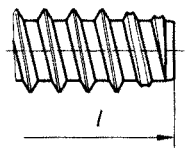
Figure 88</td><td><table><tr><th>n</th><th>Tolerance [a]</th></tr><tr><td>$\leqslant 1$</td><td>+ 0,20
+ 0,06</td></tr><tr><td>$> 1 \leqslant 3$</td><td>+ 0,31
+ 0,06</td></tr><tr><td>$> 3 \leqslant 6$</td><td>+ 0,37
+ 0,07</td></tr></table></td><td>[a] Tolerance field
C13 for $n \leqslant 1$
C14 for $n > 1$</td></tr>
<tr><td>5.1.2.2.2 Depth of slots
 

Figure 89</td><td>The depth of slots is specified in product standards.</td><td></td></tr>
</table>

Feature	Tolerance	Notes
5.1.2.2.3 Cross recesses	See ISO 4757 for all dimensions except penetration depths. For penetration depths see appropriate product standard.	
5.1.2.2.4 Hexalobular recess	See ISO 10664 for all dimensions except penetration depths. For penetration depths see appropriate product standard.	
5.1.3 Other features **5.1.3.1 Head diameters**  **Figure 90**	h14	Combined control of diameter and height for countersunk head screws as specified in ISO 7721.
5.1.3.2 Head height  **Figure 91**	h14	
 **Figure 92**	For countersunk head screws k is defined in product standards only as a maximum.	Combined control of diameter and height for countersunk head screws as specified in ISO 7721.

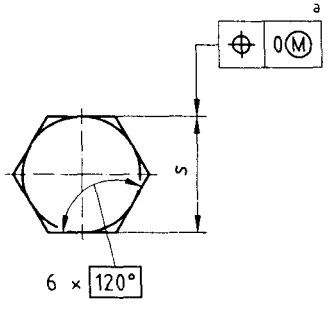
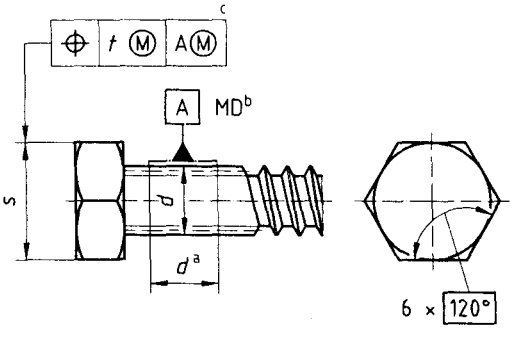
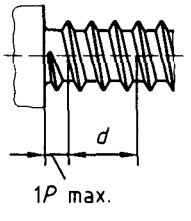
Feature	Tolerance	Notes
5.1.3.3 Length   Type C  Type R  Type F **Figure 93**	**Types C and R** l / Tolerance ≤ 25 / ± 0,8 > 25 / ± 1,3 **Type F** l / Tolerance ≤ 19 / 0 -0,8 > 19 ≤ 38 / 0 -1,3 > 38 / 0 -1,5	

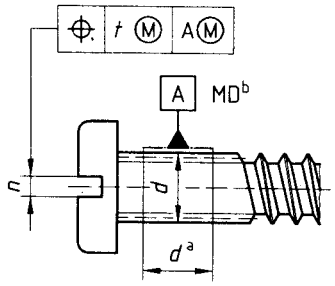
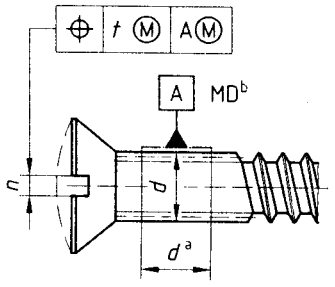
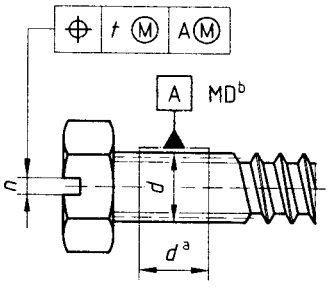
5.2 Geometrical tolerances — Product grade A

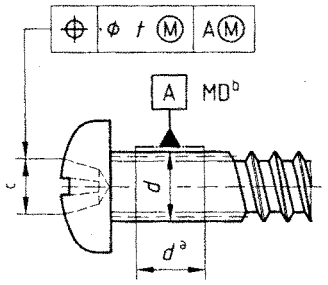
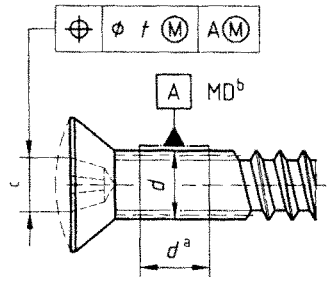
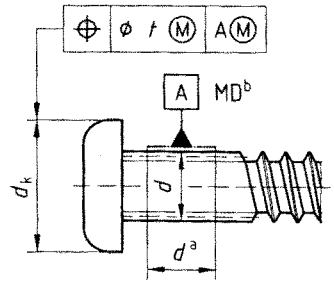
In accordance with ISO 1101 and ISO 2692 the tolerances of form and position indicated in Figures 94 to 104 do not necessarily imply the use of any particular method of production, measurement or gauging.

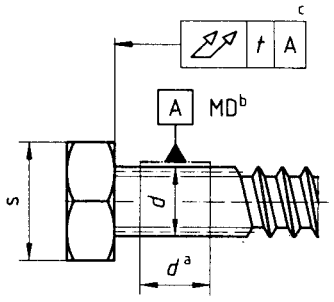
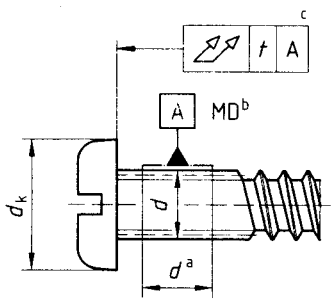
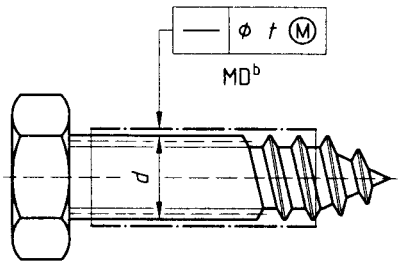
Where a tapping screw thread is indicated either as the datum or as the toleranced feature the axis shall be determined from the major diameter of the thread.

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

Feature	Tolerance t	Tolerance t based on dimension	Notes
5.2.1 Driving features **5.2.1.1 Tolerance of form**  a 3 × simultaneously. **Figure 94**			
5.2.1.2 Tolerances of position  a The datum A shall be as close to the head as possible but within 1 P distance of the head. It 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 according to ISO 1101. c 3 × simultaneously. **Figure 95**	2 IT13	s	

Feature	Tolerance t	Tolerance t based on dimension	Notes
 a, b See Figure 95. **Figure 96**	2 IT12	d	
 a, b See Figure 95. **Figure 97**	2 IT12	d	
 a, b See Figure 95. **Figure 98**	2 IT12	d	

Feature	Tolerance t	Tolerance t based on dimension	Notes
	2 IT13	d	
a, b See Figure 95. c For referee purposes assessment of co-axiality of cross recess features shall be by means of a penetration gauge point in accordance with ISO 4757. **Figure 99**			
	2 IT13	d	
a, b See Figure 95. c See Figure 99. **Figure 100**			
5.2.2 Other features **5.2.2.1 Tolerance of position** 	2 IT13	d_k	
a, b See Figure 95. **Figure 101**			

Feature	Tolerance t	Tolerance t based on dimension	Notes
5.2.2.2 Total run-out  a, b See Figure 95. c Up to 0,8s diameter only. **Figure 102**		d	Tolerance t calculated as follows: $t \approx 1{,}2\ d \times \tan 2°$
 a, b See Figure 95. c up to 0,8 d_k diameter only. **Figure 103**	d / t ST2,2 / 0,08 ST2,9 / 0,16 ST3,5 / 0,16 ST4,2 / 0,16 ST4,8 / 0,3 ST5,5 / 0,3 ST6,3 / 0,3 ST8 / 0,34 ST9,5 / 0,42	d	
5.2.2.3 Straightness  b See Figure 95. **Figure 104**	$t = 0{,}003l + 0{,}05$	—	for $l \leqslant 20d$

Annex A
(informative)

Tolerances

Numerical values of IT tolerance grades are given in Table A.1 and the limit deviations for shafts and for holes are given in Tables A.2 and A.3 respectively. These tolerances are taken from ISO 286-1 and ISO 286-2.

Table A.1 — Numerical values of standard tolerance grades IT for basic sizes up to 500 mm

Nominal dimension		Standard tolerance grades					
>	⩽	IT12	IT13	IT14	IT15	IT16	IT17
		Tolerances					
	3	0,1	0,14	0,25	0,4	0,6	1
3	6	0,12	0,18	0,3	0,48	0,75	1,2
6	10	0,15	0,22	0,36	0,58	0,9	1,5
10	18	0,18	0,27	0,43	0,7	1,1	1,8
18	30	0,21	0,33	0,52	0,84	1,3	2,1
30	50	0,25	0,39	0,62	1	1,6	2,5
50	80	0,3	0,46	0,74	1,2	1,9	3
80	120	0,35	0,54	0,87	1,4	2,2	3,5
120	180	0,4	0,63	1	1,6	2,5	4
180	250	0,46	0,72	1,15	1,85	2,9	4,6
250	315	0,52	0,81	1,3	2,1	3,2	5,2
315	400	0,57	0,89	1,4	2,3	3,6	5,7
400	500	0,63	0,97	1,55	2,5	4	6,3

Table A.2 — Limit deviations for shafts

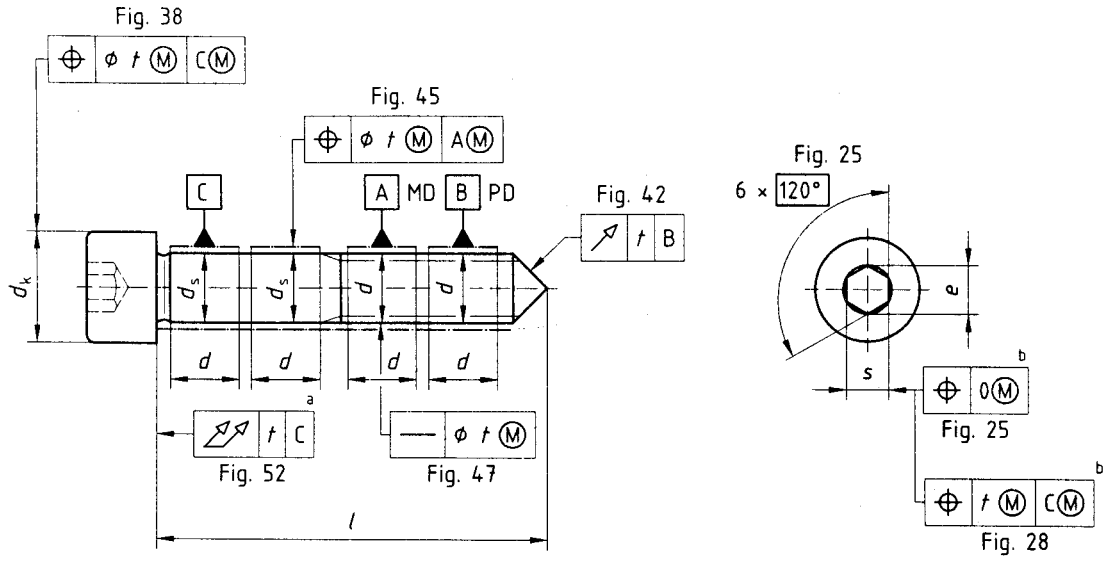
Nominal dimension		Limit deviations								
>	⩽	h13	h14	h15	h16	h17	js14	js15	js16	js17
	3	0 −0,14	0 −0,25	0 −0,4	0 −0,6	0 −1	±0,125	±0,2	±0,3	±0,5
3	6	0 −0,18	0 −0,3	0 −0,48	0 −0,75	0 −1,2	±0,15	±0,24	±0,375	±0,6
6	10	0 −0,22	0 −0,36	0 −0,58	0 −0,9	0 −1,5	±0,18	±0,29	±0,45	±0,75
10	18	0 −0,27	0 −0,43	0 −0,7	0 −1,1	0 −1,8	±0,215	±0,35	±0,55	±0,9
18	30	0 −0,33	0 −0,52	0 −0,84	0 −1,3	0 −2,1	±0,26	±0,42	±0,65	±1,05
30	50	0 −0,39	0 −0,62	0 −1	0 −1,6	0 −2,5	±0,31	±0,5	±0,8	±1,25
50	80	0 −0,46	0 −0,74	0 −1,2	0 −1,9	0 −3,0	±0,37	±0,6	±0,95	±1,5
80	120	0 −0,54	0 −0,87	0 −1,4	0 −2,2	0 −3,5	±0,435	±0,7	±1,1	±1,75
120	180	0 −0,63	0 −1	0 −1,6	0 −2,5	0 −4	±0,5	±0,8	±1,25	±2
180	250	0 −0,72	0 −1,15	0 −1,85	0 −2,9	0 −4,6	±0,575	±0,925	±1,45	±2,3
250	315	0 −0,81	0 −1,3	0 −2,1	0 −3,2	0 −5,2	±0,65	±1,05	±1,6	±2,6
315	400	0 −0,89	0 −1,4	0 −2,3	0 −3,6	0 −5,7	±0,7	±1,15	±1,8	±2,85
400	500	0 −0,97	0 −1,55	0 −2,5	0 −4	0 −6,3	±0,775	±1,25	±2	±3,15

Table A.3 — Limit deviations for holes

Nominal dimension		Limit deviations												
>	≤	C13	C14	D9	D10	D11	D12	EF8	11	E12	H14	H15	JS9	K9
	3	+ 0,2 + 0,06	+ 0,31 +0,06	+ 0,045 + 0,02	+ 0,06 + 0,02	+ 0,08 + 0,02	+ 0,12 + 0,02	+ 0,024 + 0,01	+ 0,074 + 0,014	+ 0,114 + 0,014	+ 0,25 0	+ 0,4 0	± 0,012 5	0 − 0,025
3	6	+ 0,25 + 0,07	+ 0,37 + 0,07	+ 0,06 + 0,03	+ 0,078 + 0,03	+ 0,105 + 0,03	+ 0,15 + 0,03	+ 0,032 + 0,014	+ 0,095 + 0,02	+ 0,14 + 0,02	+ 0,3 0	+ 0,48 0	± 0,015	0 − 0,03
6	10					+ 0,13 + 0,04	+ 0,19 + 0,04	+ 0,04 + 0,018	+ 0,115 + 0,025	+ 0,175 + 0,025	+ 0,36 0	+ 0,58 0	± 0,018	0 − 0,036
10	18						+ 0,23 + 0,05		+ 0,142 + 0,032	+ 0,212 + 0,032	+ 0,43 0	+ 0,7 0		
18	30						+ 0,275 + 0,065				+ 0,52 0	+ 0,84 0		
30	50						+ 0,33 + 0,08				+ 0,62 0	+ 1 0		
50	80						+ 0,4 + 0,1				+ 0,74 0	+ 1,2 0		
80	120						+ 0,47 + 0,12				+ 0,87 0	+ 1,4 0		
120	180										+ 1 0	+ 1,6 0		
180	250										+ 1,15 0	+ 1,85 0		
250	315										+ 1,3 0	+ 2,1 0		
315	400										+ 1,4 0	+ 2,3 0		
400	500										+ 1,55 0	+ 2,5 0		

Annex B
(informative)

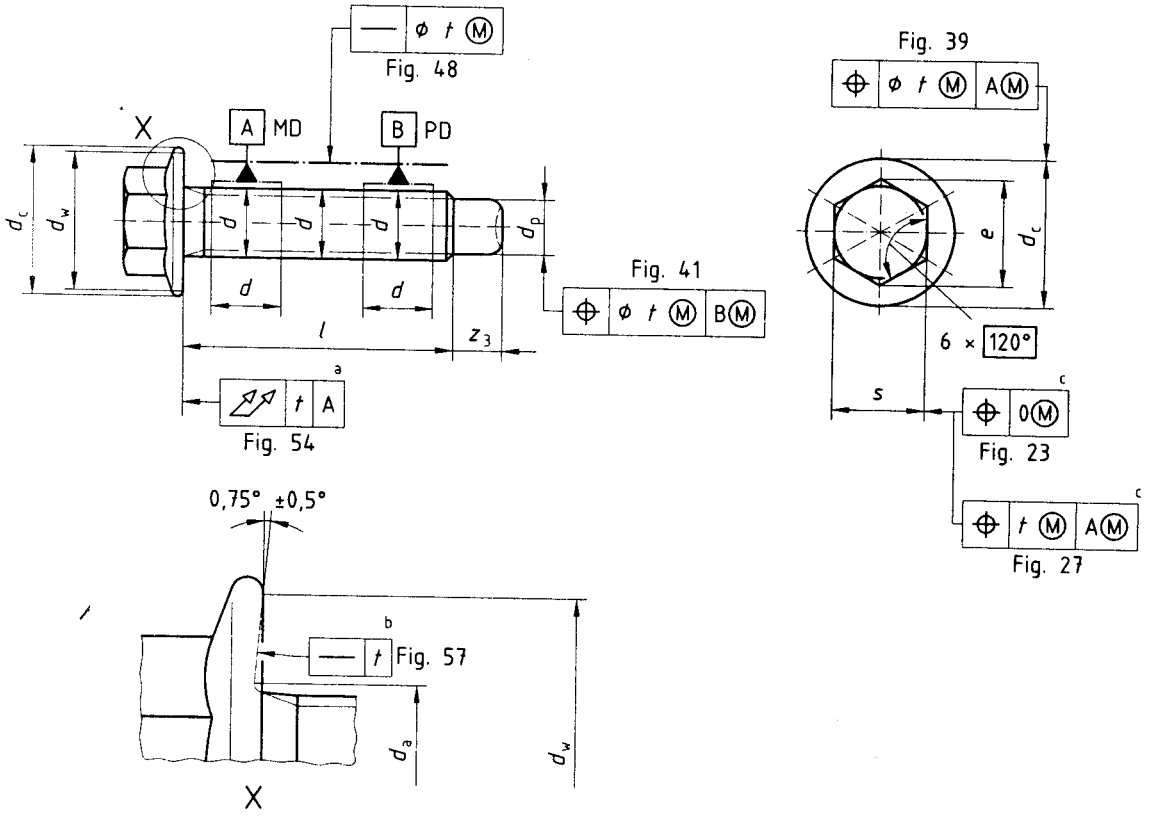
Examples of dimensioned and toleranced fasteners



a Up to 0,8 d_k diameter only.

b 3 × simultaneously.

Figure B.1 — Hexagon socket head cap screw with shank and cone point

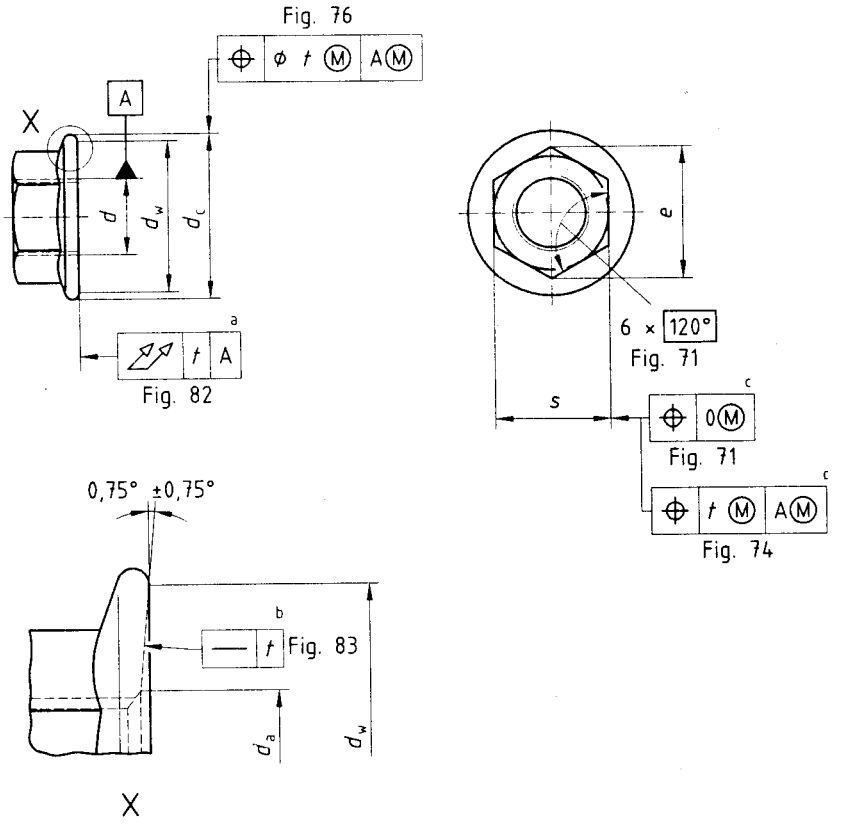


a Line of highest points on any radial line.

b Radial lines between $d_{a\ max}$ and $d_{w\ min}$.

c 3 × simultaneously.

Figure B.2 — Hexagon head bolt with flange and pilot point



a Line of highest points on any radial line.

b Radial lines between $d_{a\,max}$ and $d_{w\,min}$.

c 3 × simultaneously.

Figure B.3 — Hexagon nut with flange

Annex C
(informative)

Examples of gauges and other measuring devices

C.1 Application

This annex gives examples of gauges and other measuring devices which can verify whether the tolerances specified in this part of ISO 4759 are satisfied.

The thread of gauges and measuring devices shall be within the limits for GO gauges. Guides shall have such an accuracy that errors due to the guides during inspection are negligible compared to the workpiece tolerance t (e.g. less than 10 % of t).

If the datum is not associated with the maximum material requirements, indicated by Ⓜ, the following applies:

— when the datum is an external thread, the major diameter axis (MD) or the pitch diameter axis (PD) is the datum as specified in this part of ISO 4759. When the datum is the major diameter, the part may be fixed in a 3 jaw chuck;

— when the datum is an internal thread, in the examples of this annex the nut is tightened against a conical spring washer. Another possibility is to use a tapered threaded mandrel for this purpose;

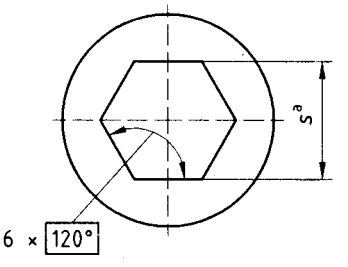
— when the datum is a plain shaft or a tapping screw thread it may be fixed in a 3 jaw chuck regardless of the feature size;

C.2 Gauges and other measuring devices

NOTE All gauges given in this annex are GO gauges. Diameter d_g, if existant, should be chosen by the gauge manufacturer.

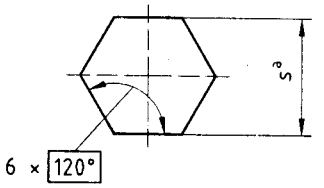
The gauges and measuring devices given in this annex are intended for the verification of geometrical tolerances specified in 3.2, 4.2 and 5.2.

Each gauge and measuring device is allocated to one or more figures in the main body of this part of ISO 4759 in order to make clear which tolerance is verified by which gauge or measuring device.



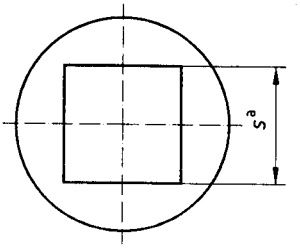
[a] Maximum material size.

Figure C.1 — Gauge for verifying form tolerance specified in Figures 23, 71 and 94



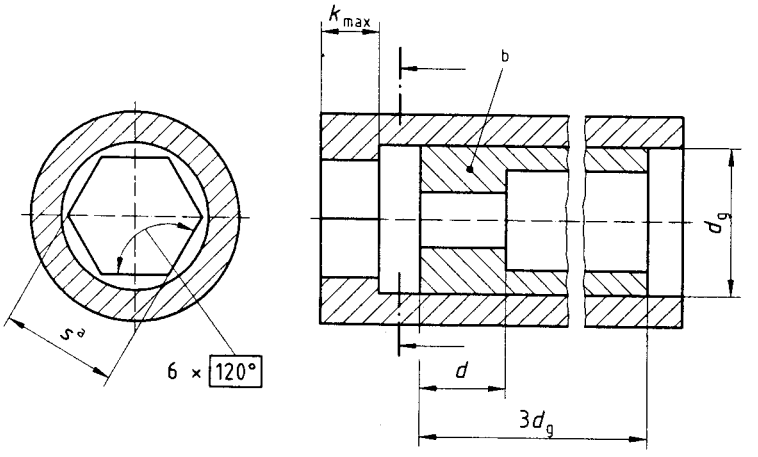
[a] Maximum material size.

Figure C.2 — Gauge for verifying form tolerance specified in figure 25



[a] Maximum material size.

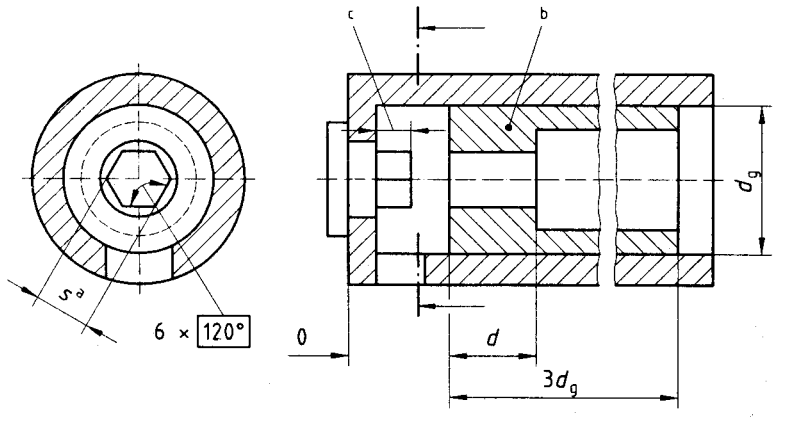
Figure C.3 — Gauge for verifying form tolerance specified in Figures 24 and 72



[a] Maximum material size + t.

[b] The GO gauge is a plain hole of maximum material size.

Figure C.4 — Gauge for verifying position tolerance specified in Figures 26, 27 and 95

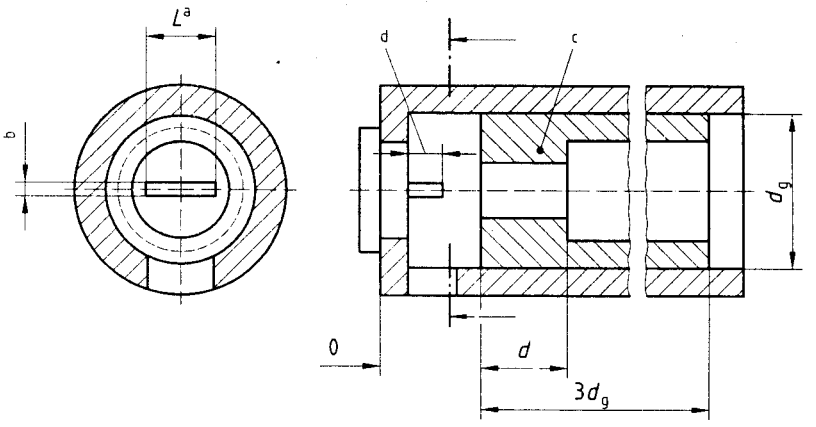


a Maximum material size – t.

b The GO gauge is a plain hole of maximum material size.

c Minimum socket depth.

Figure C.5 — gauge for verifying position tolerance specified in Figures 28, 29, 30 and 31



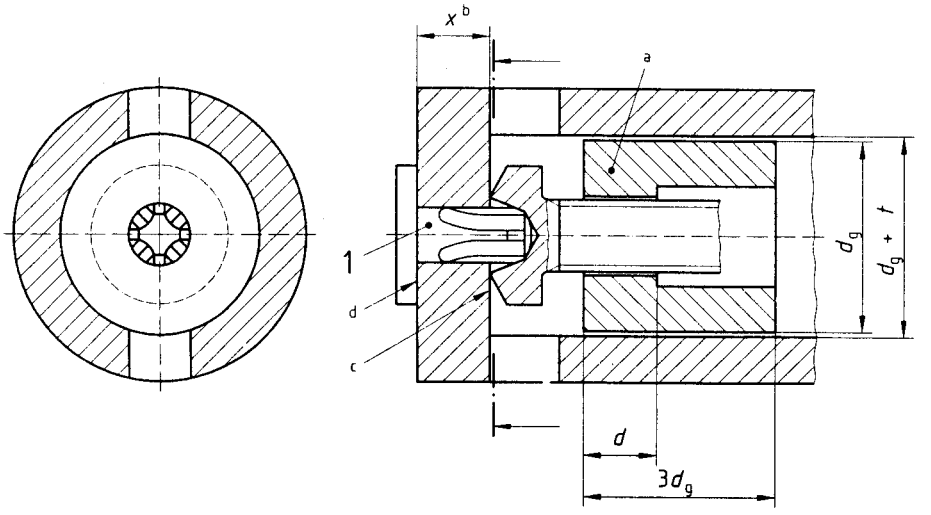
a $L > s$ (see Figures 32 and 98); $L > d_k$ (see Figures 33, 34, 96 and 97); $L > d$ (see Figure 35).

b Maximum material size – t.

c The GO gauge is a plain hole of maximum material size.

d Minimum slot depth.

Figure C.6 — Gauge for verifying position tolerance specified in Figures 32, 33, 34, 35, 96, 97 and 98



Key

1 Gauge pin in accordance with ISO 4757

NOTE This gauge does not check the size of the recess, e.g. an oversized cross recess is not recognized.

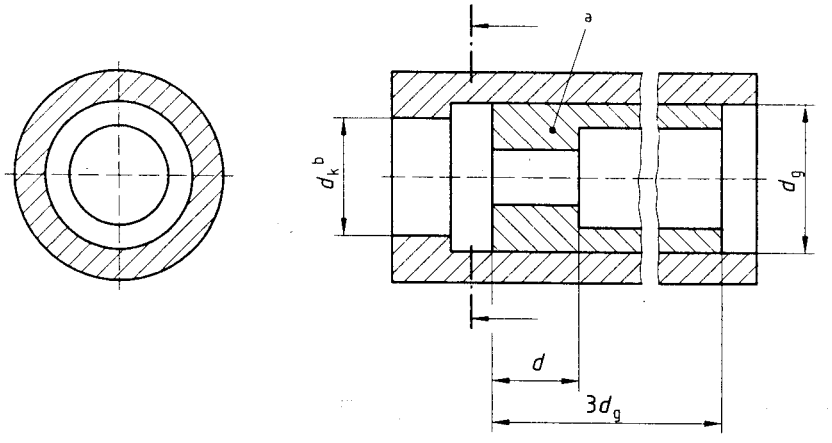
a The GO gauge is a plain hole of maximum material size.

b x is a function of length of gauge pin and the required penetration of the recess.

c First contact.

d Contact shall be achieved.

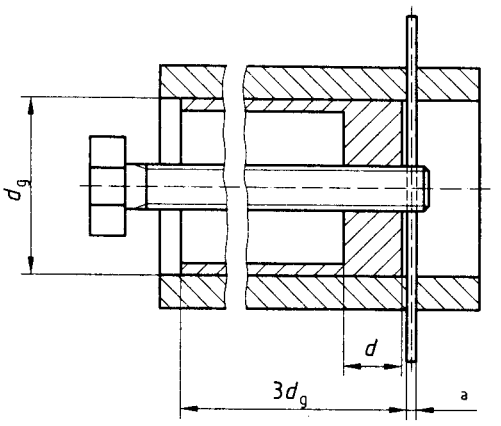
Figure C.7 — Gauge for verifying position tolerance specified in Figures 36, 37, 99 and 100



a The GO gauge is a plain hole of maximum material size.

b Maximum material size + t.

Figure C.8 — Gauge for verifying position tolerance specified in Figures 38, 39 and 101



[a] Maximum material size – t

Figure C.9 — Gauge for verifying position tolerance specified in Figure 40

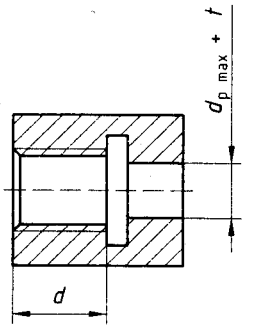
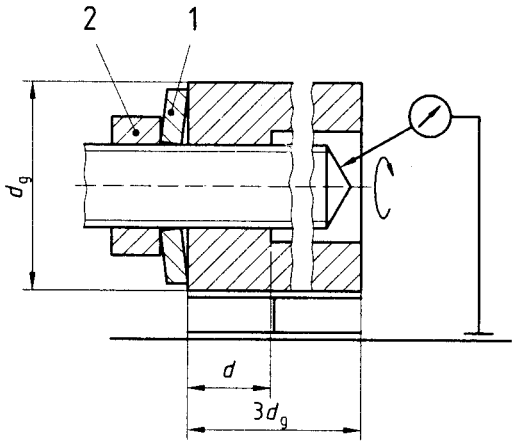


Figure C.10 — Gauge for verifying position tolerance specified in Figure 41

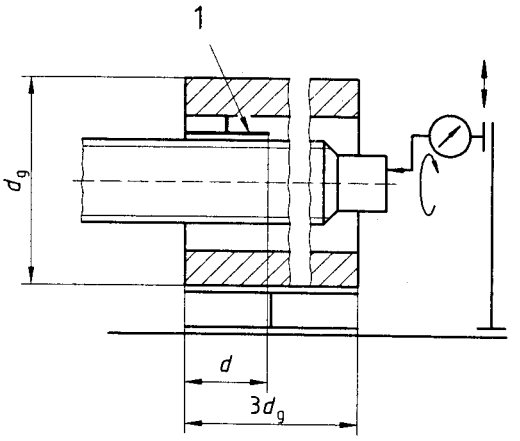


Key

1 Gauge conical spring washer

2 Gauge counter nut

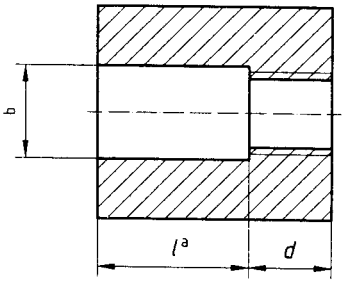
Figure C.11 — Measuring device for verifying run-out specified in Figures 42 and 43



Key

1 Three jaw chuck

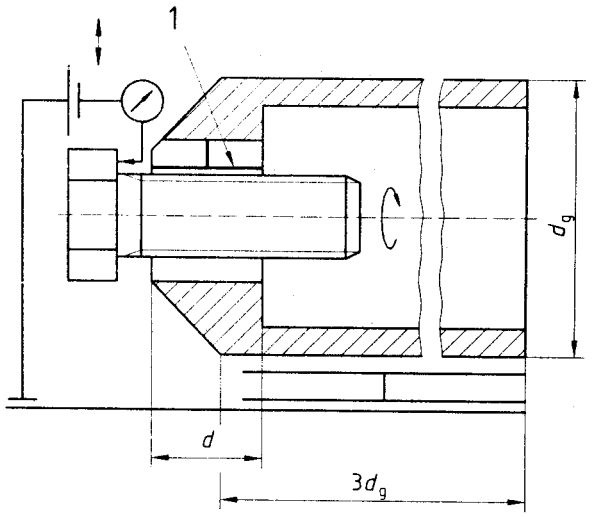
Figure C.12 — Measuring device for verifying total run-out specified in Figure 56



a l depends on the distance between the datum feature and the end of the toleranced feature.

b Maximum material size + t.

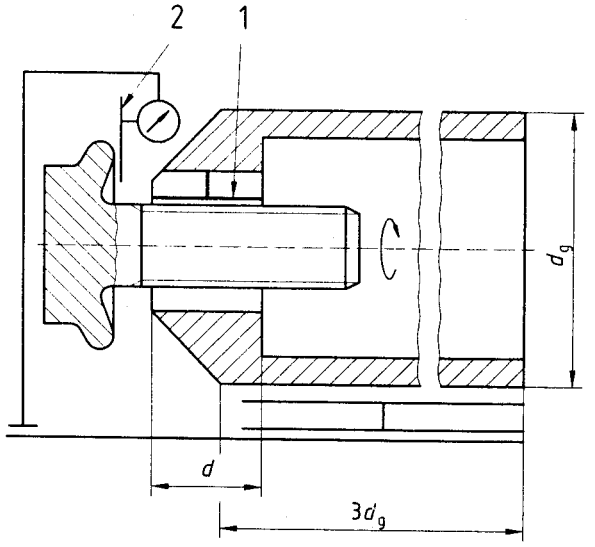
Figure C.13 — Gauge for verifying position tolerance specified in Figures 44, 45 and 46



Key

1 Three jaw chuck

Figure C.14 — measuring device for verifying perpendicularity (total run-out) specified in Figures 51, 52, 53, 55, 102 and 103

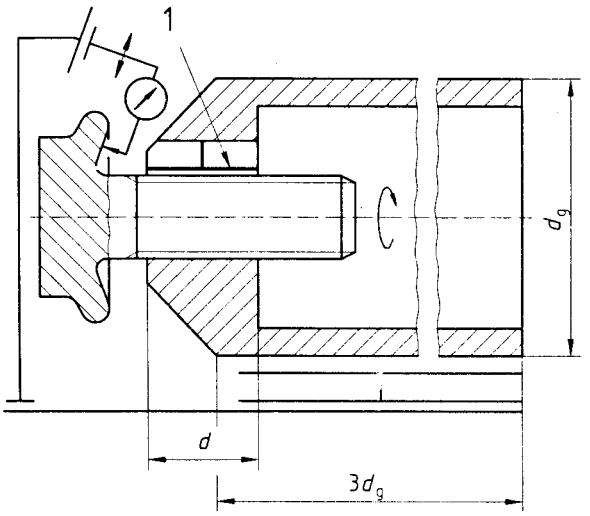


Key

1 Three jaw chuck

2 Straight edge anvil

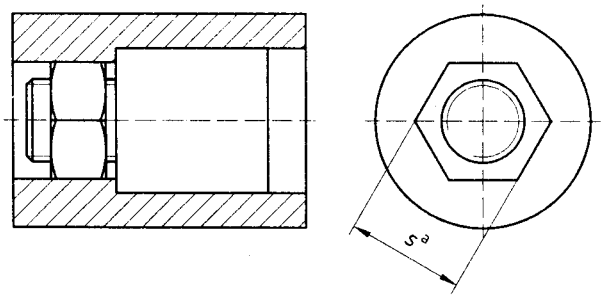
Figure C.15 — Measuring device for verifying perpendicularity (total run-out) specified in Figure 54



Key

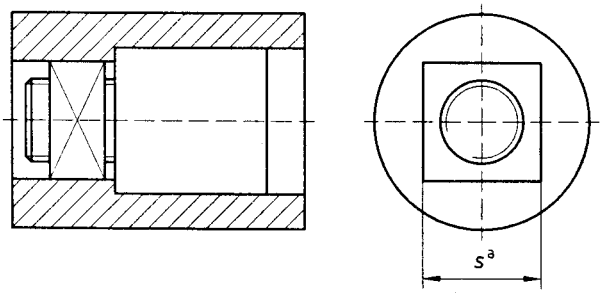
1 Three jaw chuck

Figure C.16 — Measuring device for verifying permissible deviation from the form of bearing face specified in Figure 57



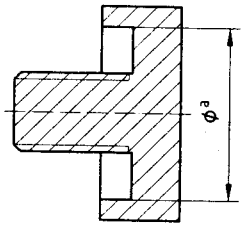
[a] Maximum material size + t.

Figure C.17 — Gauge for verifying position tolerance specified in Figures 73 and 74



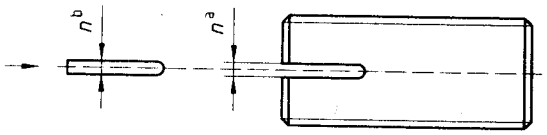
[a] Max. mat. size + t.

Figure C.18 — Gauge for verifying position tolerance specified in Figure 75



[a] Max. mat. size + t.

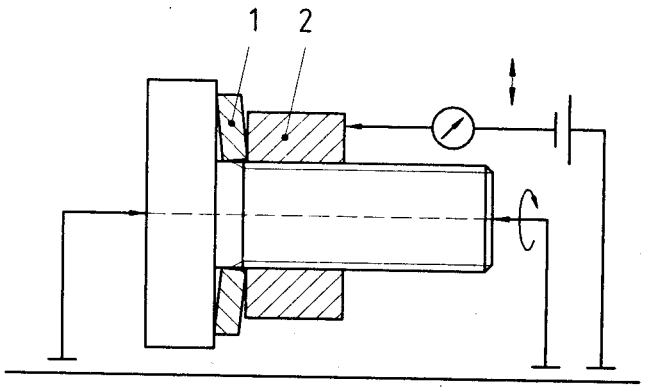
Figure C.19 — Gauge for verifying position tolerance specified in Figures 76 and 78



[a] Max. mat. size.

[b] Max. mat. size – t.

Figure C.20 — Gauge for verifying position tolerance specified in Figure 77

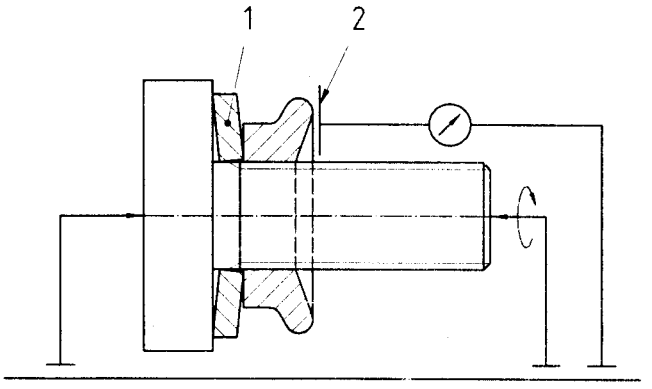


Key

1 Gauge conical spring washer

2 Fastener

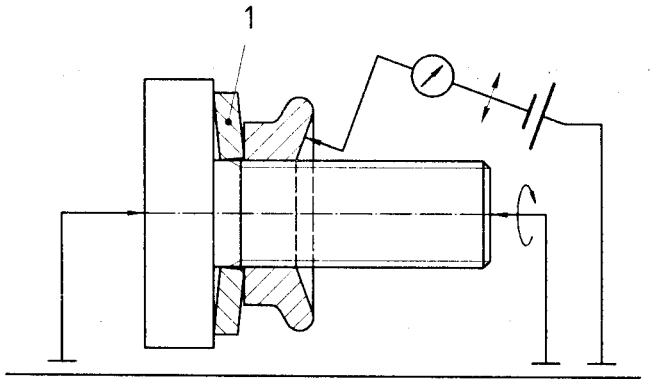
Figure C.21 — measuring device for verifying perpendicularity (total run-out) specified in Figures 79, 80 and 81



Key

1 Gauge conical spring washer
2 Straight edge anvil

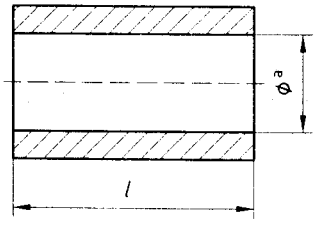
Figure C.22 — Measuring device for verifying perpendicularity (total run-out) specified in Figure 82



Key

1 Gauge conical spring washer

Figure C.23 — Measuring device for verifying permissible deviation from the form of bearing face specified in Figure 83



[a] Maximum material size + t.

Figure C.24 — Gauge for verifying straightness specified in Figures 47, 48, 49, 50 and 104

(*Continued from second cover*)

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
ISO 1478:1999	IS 5957:2002 Screw threads for thread forming tapping screw — Dimensions (*second revision*)	Identical
ISO 2692:1988	IS 8000(Part 2):1992 Technical drawings — Geometrical tolerances: Part 2 Maximum material principles (*first revision*)	do
ISO 4032:1999	IS 1364(Part 3):2002 Hexagon head bolts, screws and nuts of product grades A and B: Part 3 Hexagon nuts size range M1.6 to M64 (*fourth revision*)	do
ISO 4042:1999	IS 1367(Part 11):2002 Technical supply conditions for threaded steel fasteners: Part 11 Electroplated coatings (*third revision)*	do
ISO 4757:1983	IS 7478:1985 Dimensions for cross recesses(*first revision*)	Technically equivalent
	IS 7479:1985 Recesses penetration gauges(*first revision*)	do
ISO 7721:1983	IS 11362:1985 Head configuration and gauging of countersunk head screws	Identical
ISO 8015:1985	IS 12160:1987 Technical drawings — Fundamental tolerancing principles	do
ISO 10642:1997	IS 6761:1994 Countersunk head screws with hexagon socket (*first revision*)	Technically equivalent

The concerned Technical Committee has reviewed the provisions of the following ISO Standards referred in this adopted standard and has decided that they are acceptable for use in conjunction with this standard:

ISO Standard	*Title*
ISO 1479:1983	Hexagon head tapping screws
ISO 7053:1992	Hexagon washer head tapping screws
ISO 10509:1992	Hexagon flange head tapping screws
ISO 10664:1999	Hexalobular internal driving feature for bolts and screws

In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2:1960 'Rules for rounding off numerical values (*revised*)'.

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Review of Indian Standards

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Amendments Issued Since Publication

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