INTERNATIONAL STANDARD

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
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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 ans 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

Symbols and designations of dimensions are specified in ISO 225.

<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>3.1.1 Tolerance level

Shank and bearing surface
Other features</td><td>

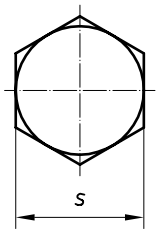
close
close</td><td>

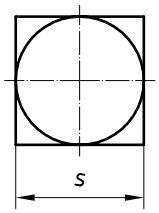
close
wide</td><td>

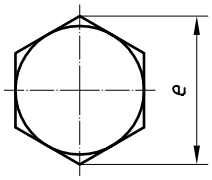
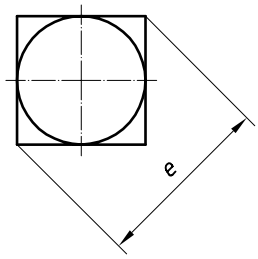
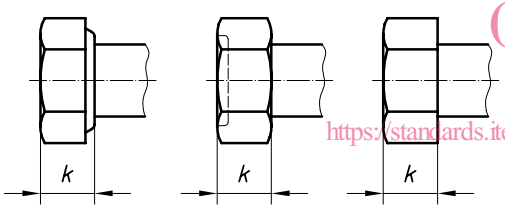
wide
wide</td><td></td></tr>
<tr><td>3.1.2 External thread</td><td>6g</td><td>6g</td><td>8g
(but 6g for property class 8.8 and higher)</td><td>For certain products and coatings, other tolerance classes for threads may be specified in the relevant product and coating standards.</td></tr>
<tr><td>3.1.3 Driving features

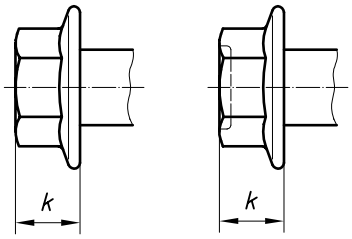
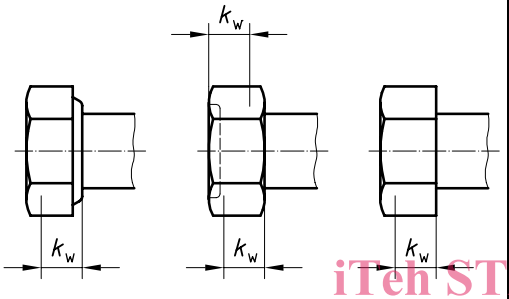
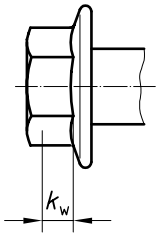
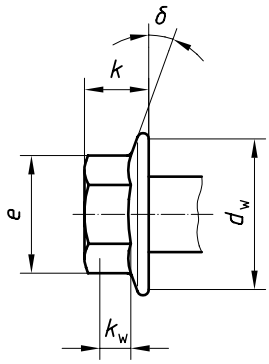
3.1.3.1 External

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>Feature</th><th colspan="4">Tolerance for product grades
A | B | C</th><th>Notes</th></tr>
<tr><td>3.1.3.1.2 Width across corners
 
Figure 3</td><td colspan="4">$e_{min} = 1{,}13\ s_{min}$
$e_{min} = 1{,}12\ s_{min}$ 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="4">$e_{min} = 1{,}3\ s_{min}$</td><td></td></tr>
<tr><td rowspan="2">3.1.3.1.3 Height of head
 
Figure 5</td><td rowspan="2">js14</td><td rowspan="2">js15</td><td>k</td><td>Tolerance</td><td rowspan="2"></td></tr>
<tr><td>< 10
$\geqslant 10$</td><td>js16
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'. [b] For gauging, see annex A of the product standards
 **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)**	

<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

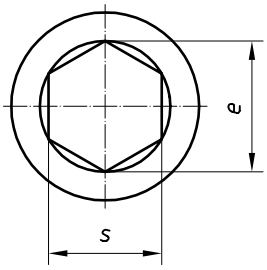
 

Figure 9</td><td>$e_{min} = 1{,}14\ s_{min}$

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

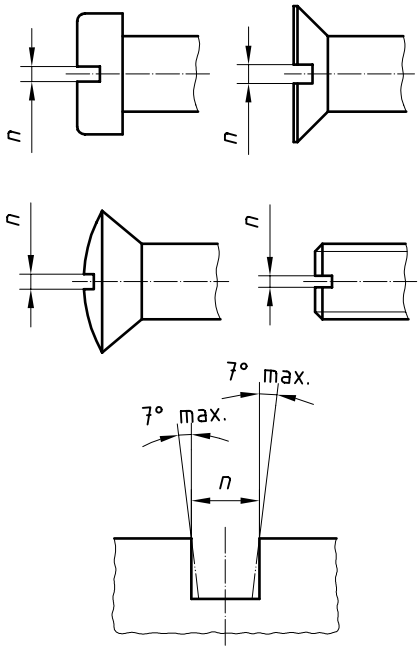
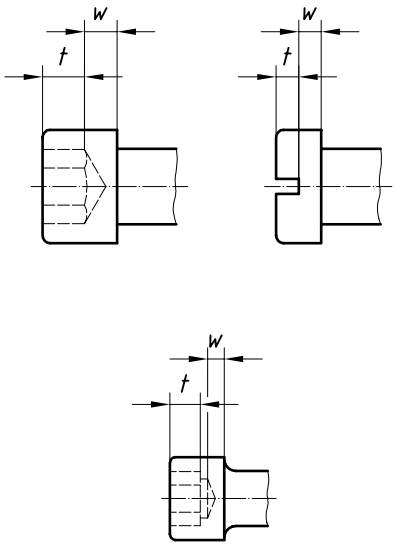
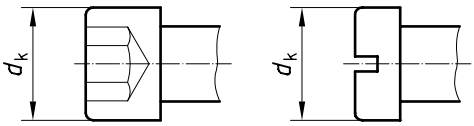
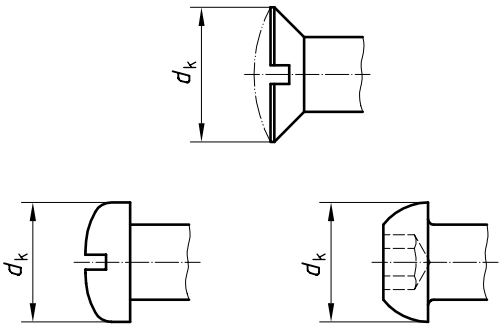
 

Figure 10</td><td><table><tr><th>n</th><th>Tolerance</th></tr><tr><td>$\leqslant 1$</td><td>+ 0,20
+ 0,06</td></tr><tr><td>$> 1 \leqslant 3$</td><td>+ 0,31
+ 0,06</td></tr><tr><td>$> 3 \leqslant 6$</td><td>+ 0,37
+ 0,07</td></tr></table></td><td>—</td><td>—</td><td>Tolerance field
C13 for $n \leqslant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

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

Feature	Tolerance for product grades A	B	C	Notes
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.

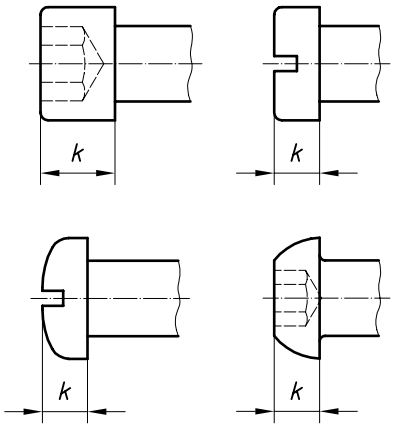
<table>
<tr><th>Feature</th><th colspan="3">Tolerance for product grades</th><th>Notes</th></tr>
<tr><th></th><th>A</th><th>B</th><th>C</th><th></th></tr>
<tr><td>3.1.4.2 Head height (except for hexagon heads)
 

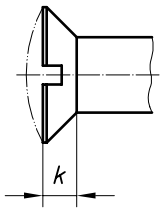
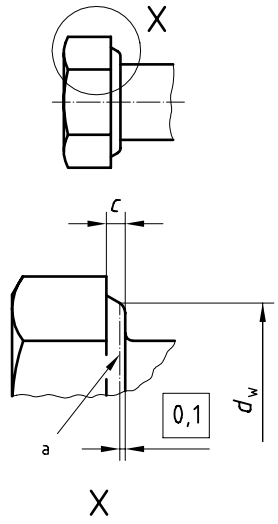
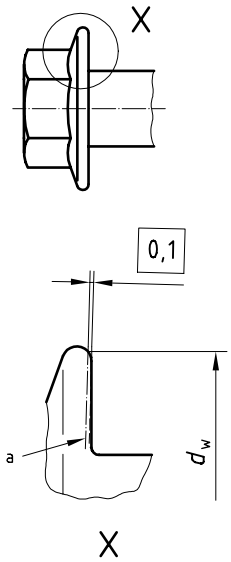
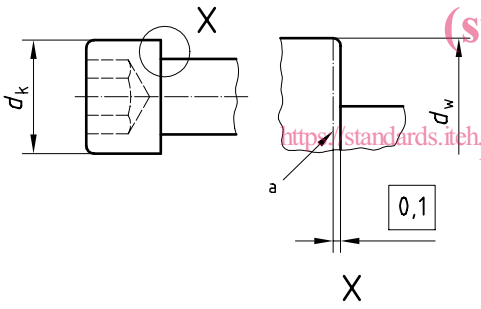
Figure 14</td><td>≤ M5: h13
> M5: h14</td><td>—</td><td>—</td><td></td></tr>
<tr><td> 

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>Thread diameter</th><th colspan="2">c</th></tr><tr><th></th><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> 

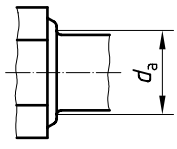
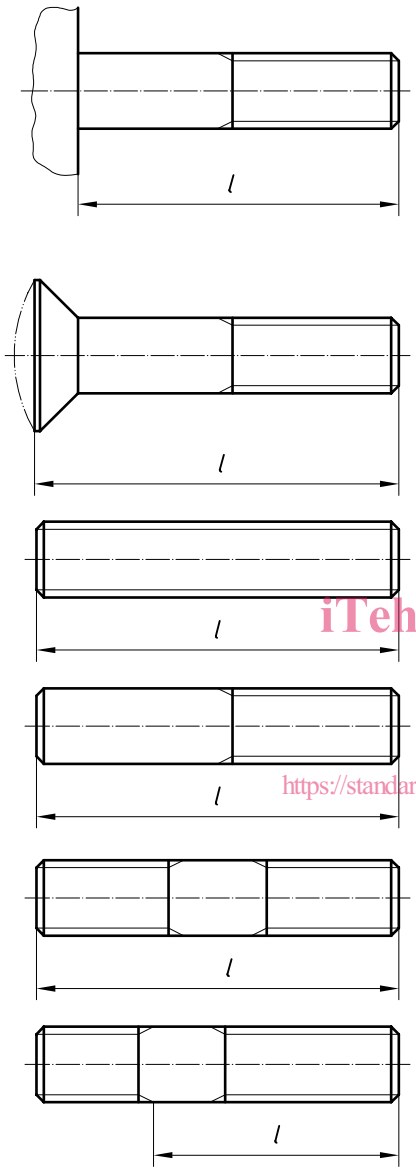
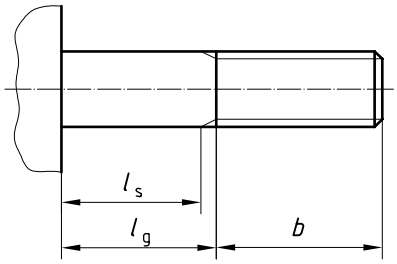
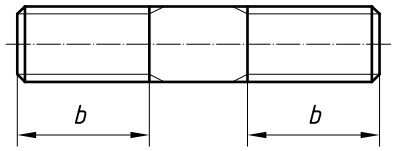
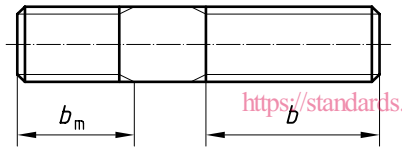
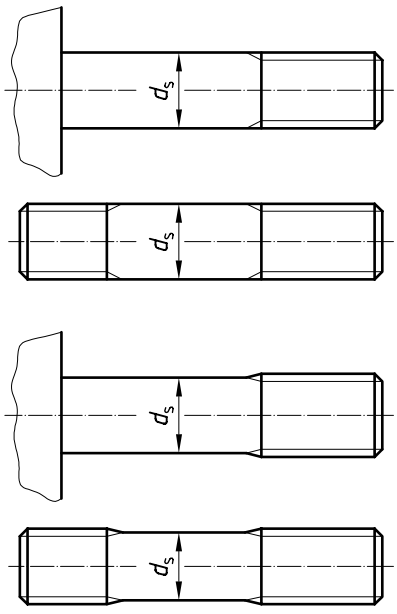
a Reference datum for d_w
Figure 18</td><td colspan="3"><table>
<tr><th colspan="2">Thread diameter</th><th>d_w</th></tr>
<tr><th>></th><th>⩽</th><th>min.</th></tr>
<tr><td></td><td>2,5</td><td>$d_{k\ min}$ – 0,14</td></tr>
<tr><td>2,5</td><td>5</td><td>$d_{k\ min}$ – 0,25</td></tr>
<tr><td>5</td><td>10</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**  	$b^{\ +2P}_{\ 0}$	$b^{\ +2P}_{\ 0}$	$b^{\ +2P}_{\ 0}$	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.
Tie rod  	$b^{\ +2P}_{\ 0}$	$b^{\ +2P}_{\ 0}$	$b^{\ +2P}_{\ 0}$	
Stud  	$b^{\ +2P}_{\ 0}$ b_m js16	$b^{\ +2P}_{\ 0}$ b_m js17	$b^{\ +2P}_{\ 0}$ b_m js17	
Figure 21				
3.1.4.6 Shank diameter  	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			
Figure 22				