

Australian Standard™

## **Tolerances for ISO metric bolts, screws, studs and nuts—Product grades A, B and C**

[ISO title: Tolerances for fasteners, Part 1: Bolts, screws, studs and  
nuts—Product grades A, B and C]



**Standards Australia**



**Documents**

Document Sharing Hub

This Australian Standard was prepared by Committee ME-029, Fasteners. It was approved on behalf of the Council of Standards Australia on 16 September 2002 and published on 27 September 2002.

---

The following are represented on Committee ME-029:

Australian Industry Group  
Australian Chamber of Commerce and Industry  
Institute of Materials Engineering Australasia  
Australian Institute of Steel Construction  
Bureau of Steel Manufacturers of Australia  
Electricity Supply Association of Australia  
Federal Chamber of Automotive Industries

---

### **Keeping Standards up-to-date**

Standards are living documents which reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued. Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments which may have been published since the Standard was purchased.

Detailed information about Standards can be found by visiting the Standards Australia web site at [www.standards.com.au](http://www.standards.com.au) and looking up the relevant Standard in the on-line catalogue.

Alternatively, the printed Catalogue provides information current at 1 January each year, and the monthly magazine, *The Australian Standard*, has a full listing of revisions and amendments published each month.

We also welcome suggestions for improvement in our Standards, and especially encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Contact us via email at [mail@standards.com.au](mailto:mail@standards.com.au), or write to the Chief Executive, Standards Australia International Ltd, GPO Box 5420, Sydney, NSW 2001.

---

*This Standard was issued in draft form for comment as DR 02302.*

Australian Standard™

**Tolerances for ISO metric bolts, screws,  
studs and nuts— Product grades A, B  
and C**

First published as AS 5066—2002.

**COPYRIGHT**

© Standards Australia International

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher.

Published by Standards Australia International Ltd  
GPO Box 5420, Sydney, NSW 2001, Australia

ISBN 0 7337 4848 1

## PREFACE

This Standard was prepared by the Standards Australia Committee ME-029, Fasteners.

The objective of this Standard is to provide manufacturers, suppliers and users with tolerances for the principle features of product grades A, B and C metric bolts, screws, studs and nuts and product grade A tapping screws.

This Standard is identical with and has been reproduced from ISO 4759-1:2000, *Tolerances for fasteners*, Part 1: *Bolts, screws, studs and nuts—Product grades A, B and C*.

Statements expressed in mandatory terms in notes are deemed to be requirements of this Standard.

The term ‘informative’ has been used in this Standard to define the application of the annex to which it applies. An ‘informative’ annex is only for information and guidance.

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

As this Standard is reproduced from an international Standard, the following applies:

- (a) Its number does not appear on each page of text and its identify is shown only on the cover and title page.
- (b) In the source text ‘this part of ISO 4759’ should read ‘this Australian Standard’.
- (c) A full point should be substituted for a comma when referring to a decimal marker.

References to international Standards should be replaced by references to Australian or Australian/New Zealand Standards as follows:

| <i>Reference to International Standard</i> |                                                                                                                        | <i>Australian Standard or Australian/New Zealand Standard</i> |                                                                                       |
|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------------------------------|
| ISO                                        |                                                                                                                        | AS                                                            |                                                                                       |
| 225                                        | Fasteners—Bolts, screws, studs and nuts—Symbols and designation of dimensions                                          | —                                                             |                                                                                       |
| 286                                        | ISO system of limits and fits                                                                                          | 1654                                                          | ISO system of limits and fits                                                         |
| 286-1                                      | Part 1: Bases of tolerances, deviations and fits                                                                       | 1654.1                                                        | Part 1: Bases of tolerances, deviations and fits                                      |
| 286-2                                      | Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts                                  | 1654.2                                                        | Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts |
| 885                                        | General purpose bolts and screws—Metric series—Radii under the head                                                    | —                                                             |                                                                                       |
| 965                                        | ISO general purpose metric screw threads—Tolerances                                                                    | —                                                             |                                                                                       |
| 965-3                                      | Part 3: Deviations for constructional screw threads                                                                    | —                                                             |                                                                                       |
| 1101                                       | Geometrical Product Specifications (GPS)—Geometrical tolerancing—Tolerances of form, orientation, location and run-out | —                                                             |                                                                                       |

| ISO   |                                                                       | AS/NZS |                                        |
|-------|-----------------------------------------------------------------------|--------|----------------------------------------|
| 1478  | Tapping screws thread                                                 | 4411   | Tapping screws thread                  |
| 1479  | Hexagon head tapping screws                                           | 4402   | Hexagon head tapping screws            |
| 2692  | Technical drawings—Geometrical tolerancing—Maximum material principle | —      |                                        |
|       |                                                                       | AS     |                                        |
| 4032  | Hexagon nuts, style 1—Product grades A and B                          | 1112   | ISO metric hexagon nuts                |
|       |                                                                       | 1112.1 | Part 1: Style 1—Product grades A and B |
| 4042  | Fasteners—Electroplated coatings                                      | —      |                                        |
| 4745  | Cross recesses for screws                                             | —      |                                        |
|       |                                                                       | AS/NZS |                                        |
| 7053  | Hexagon washer head tapping screws                                    | 4409   | Hexagon washer head tapping screws     |
| 7721  | Countersunk head screws—Head configuration and gauging                | —      |                                        |
| 8015  | Technical drawings—Fundamental tolerancing principle                  | —      |                                        |
| 10509 | Hexagon flange head tapping screws                                    | 4410   | Hexagon flange head tapping screws     |
| 10642 | Hexagon socket countersunk head screws                                | —      |                                        |
| 10664 | Hexalobular internal driving feature for bolts and screws             | —      |                                        |

## CONTENTS

|                              |                                                              |           |
|------------------------------|--------------------------------------------------------------|-----------|
| <b>1</b>                     | <b>Scope .....</b>                                           | <b>1</b>  |
| <b>2</b>                     | <b>Normative references .....</b>                            | <b>2</b>  |
| <b>3</b>                     | <b>Tolerances for metric bolts, screws and studs .....</b>   | <b>3</b>  |
| <b>4</b>                     | <b>Tolerances for metric nuts.....</b>                       | <b>25</b> |
| <b>5</b>                     | <b>Tolerances for tapping screws.....</b>                    | <b>36</b> |
| <b>Annex A (informative)</b> | <b>Tolerances .....</b>                                      | <b>44</b> |
| <b>Annex B (informative)</b> | <b>Examples of dimensioned and toleranced fasteners.....</b> | <b>46</b> |
| <b>Annex C (informative)</b> | <b>Examples of gauges and other measuring devices .....</b>  | <b>49</b> |

## AUSTRALIAN STANDARD

### **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*.

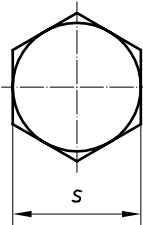
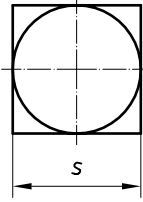
ISO 10642:1997, *Hexagon socket countersunk head screws*.

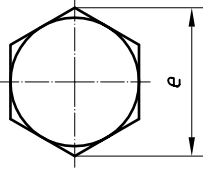
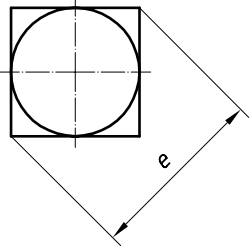
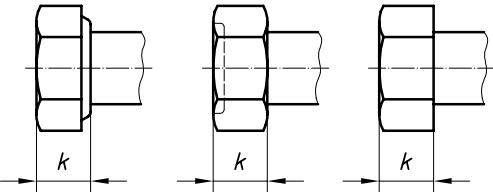
ISO 10664:1999, *Hexalobular internal driving feature for bolts and screws*.

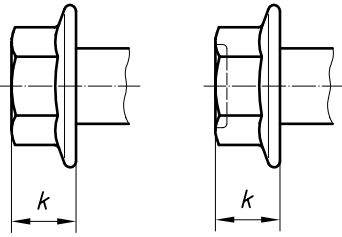
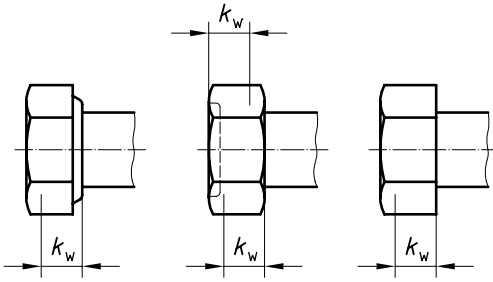
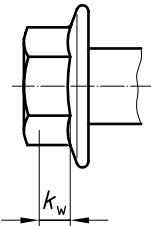
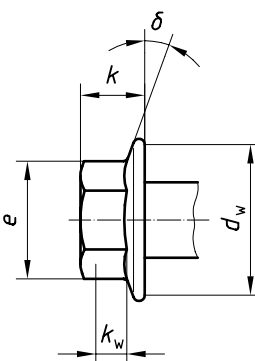
### 3 Tolerances for metric bolts, screws and studs

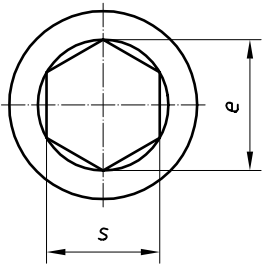
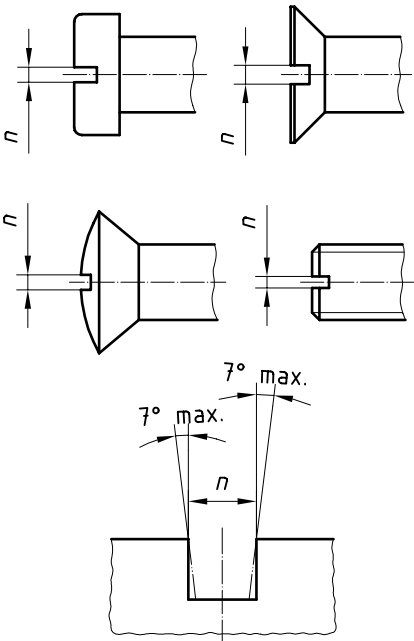
#### 3.1 Dimensional tolerances

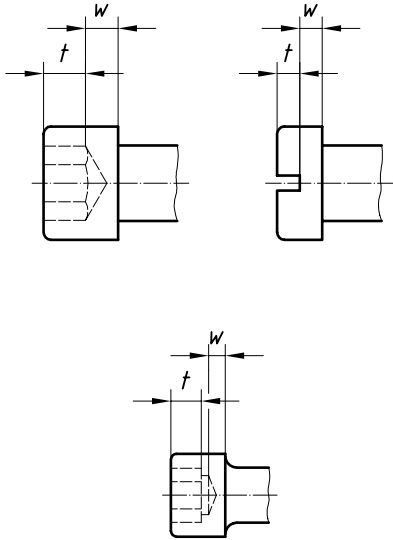
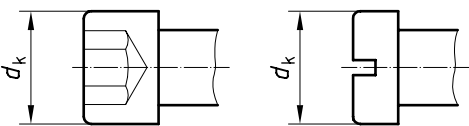
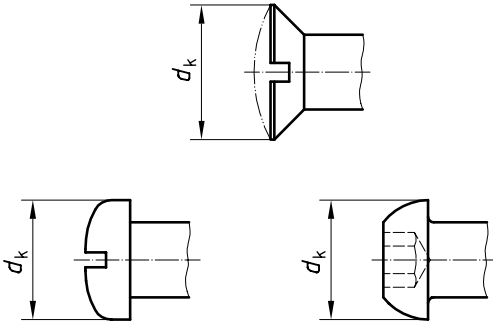
Symbols and designations of dimensions are specified in ISO 225.

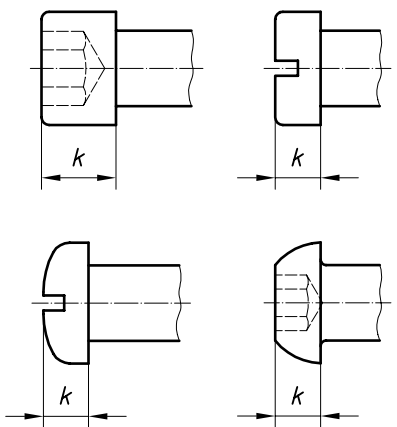
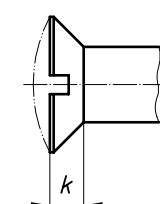
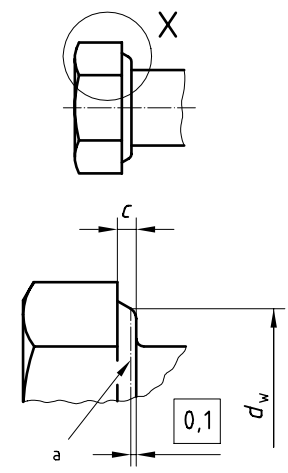
| Feature                                                                                                                                                                                                               | Tolerance for product grades |           |                                        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

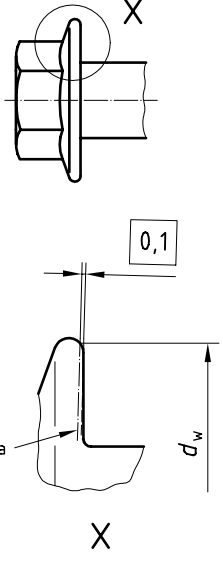
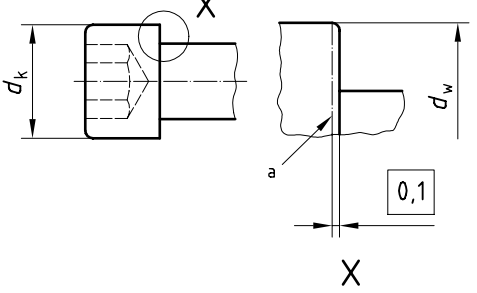
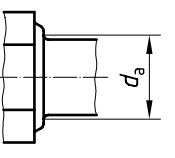
| Feature                                                                                                                                       | Tolerance for product grades                                                                                                                     |      | 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

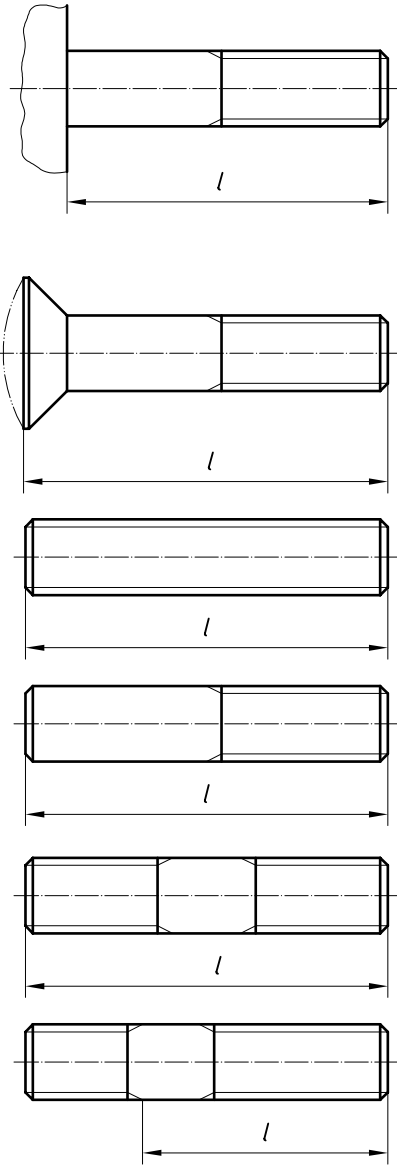
| Feature                                                                                                                                            | Tolerance for product grades                                                                                                                         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

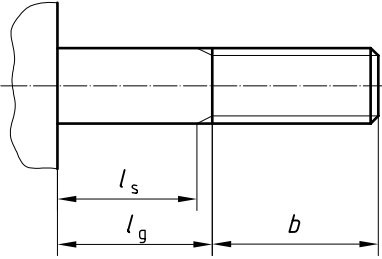
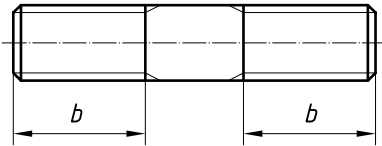
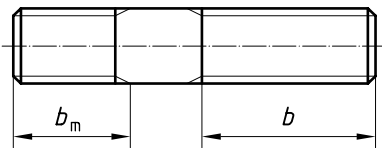
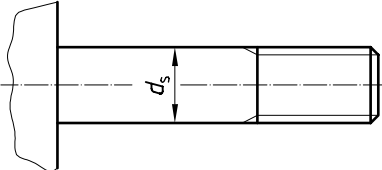
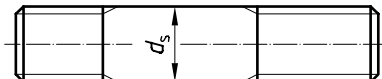
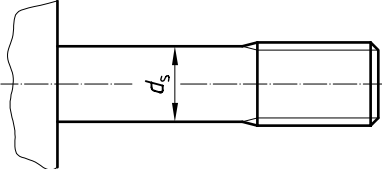
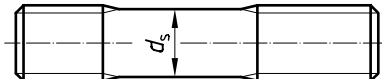
| Feature                                                                                          | Tolerance for product grades |                  |   | Notes              |
|--------------------------------------------------------------------------------------------------|------------------------------|------------------|---|--------------------|
|                                                                                                  | A                            | B                | C |                    |
| 3.1.3.2 Internal                                                                                 |                              |                  |   |                    |
| 3.1.3.2.1 Hexagon sockets                                                                        |                              |                  |   |                    |
| <br>Figure 9    | $e_{\min} = 1,14 s_{\min}$   |                  |   |                    |
|                                                                                                  | s                            | Tolerance        |   |                    |
|                                                                                                  | 0,7                          | EF8              |   |                    |
|                                                                                                  | 0,9                          | JS9              |   |                    |
|                                                                                                  | 1,3                          | K9               |   |                    |
|                                                                                                  | 1,5                          | D11              | — | —                  |
|                                                                                                  | 2                            |                  |   |                    |
|                                                                                                  | 2,5                          |                  |   |                    |
|                                                                                                  | 3                            |                  |   |                    |
|                                                                                                  | 4                            | E11              |   |                    |
|                                                                                                  | 5                            | E12              |   |                    |
|                                                                                                  | 6                            |                  |   |                    |
|                                                                                                  | 8                            |                  |   |                    |
| 10                                                                                               |                              |                  |   |                    |
| 12                                                                                               |                              |                  |   |                    |
| 14                                                                                               |                              |                  |   |                    |
| > 14                                                                                             | D12                          |                  |   |                    |
| 3.1.3.2.2 Slots                                                                                  |                              |                  |   |                    |
| <br>Figure 10 | n                            | Tolerance        |   | Tolerance field    |
|                                                                                                  | ≤ 1                          | + 0,20<br>+ 0,06 |   | C13 for $n \leq 1$ |
|                                                                                                  | > 1 ≤ 3                      | + 0,31<br>+ 0,06 |   | C14 for $n > 1$    |
|                                                                                                  | > 3 ≤ 6                      | + 0,37<br>+ 0,07 | — | —                  |

| Feature                                                                                                                                                                | Tolerance for product grades                                                                                                                     |   |   | Notes                                                                                                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|---|---|----------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                        | A                                                                                                                                                | B | C |                                                                                                                |
| <b>3.1.3.2.3 Depth of hexagon sockets and slots</b><br><br><b>Figure 11</b>           | 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.                                        |
| <b>3.1.3.2.4 Cross recesses</b>                                                                                                                                        | See ISO 4757 for all dimensions except penetration depths. For penetration depths see appropriate product standard.                              |   |   |                                                                                                                |
| <b>3.1.3.2.5 Hexalobular recesses</b>                                                                                                                                  | See ISO 10664 for all dimensions except penetration depths. For penetration depths see appropriate product standard.                             |   |   |                                                                                                                |
| <b>3.1.4 Other features</b><br><b>3.1.4.1 Head diameter</b><br><br><b>Figure 12</b> | $h13^a$                                                                                                                                          | — | — | $^a \pm IT13$ for knurled heads                                                                                |
| <br><b>Figure 13</b>                                                                | $h14$                                                                                                                                            | — | — | Combined control of diameter and height for counter-sunk head screws in accordance with ISO 7721 or ISO 10642. |

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

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

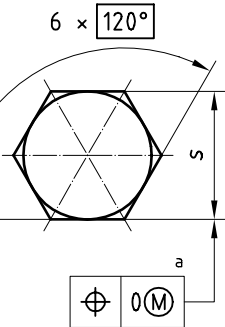
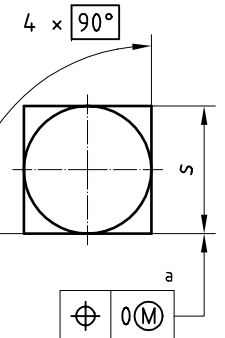
| Feature                                                                                                                             | Tolerance for product grades |      |                                               | Notes |
|-------------------------------------------------------------------------------------------------------------------------------------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

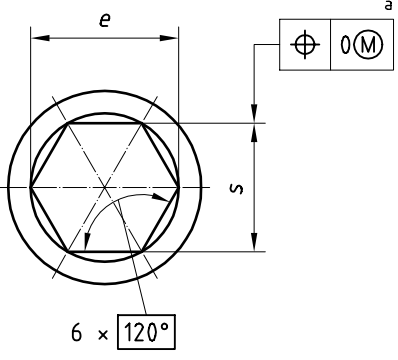
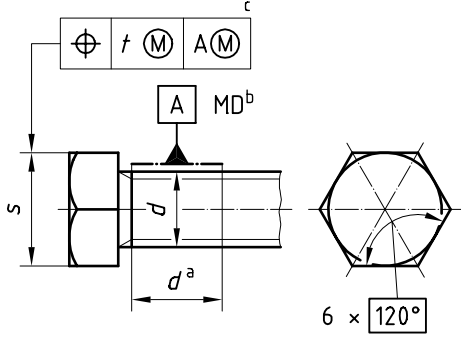
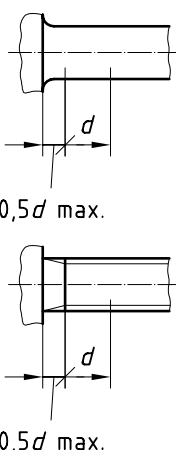
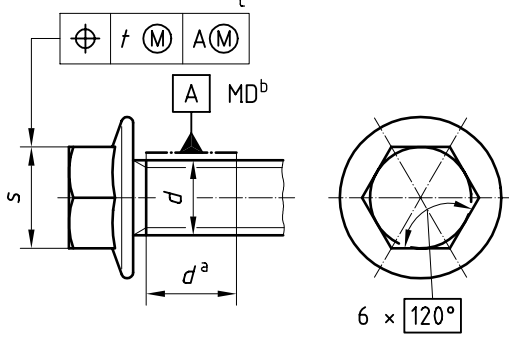
| Feature                                                                                                                                                                                                                                                                                                   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

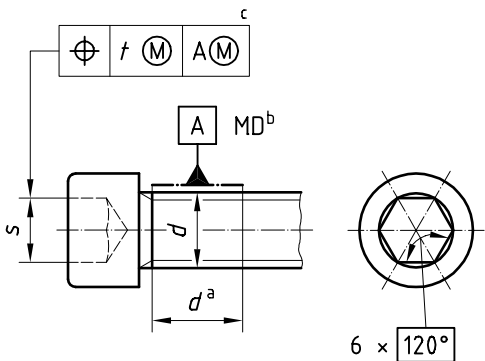
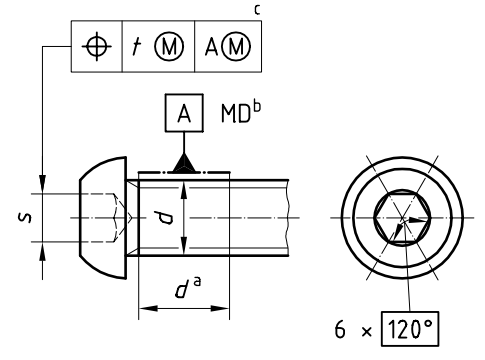
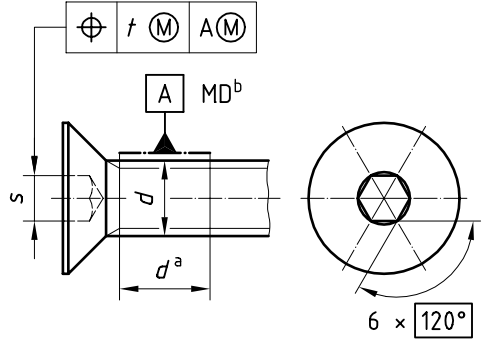
In accordance with ISO 1101 and ISO 2692 the tolerances specified in Figures 23 to 57 do not necessarily imply the use of any particular method of production, measurement or gauging.

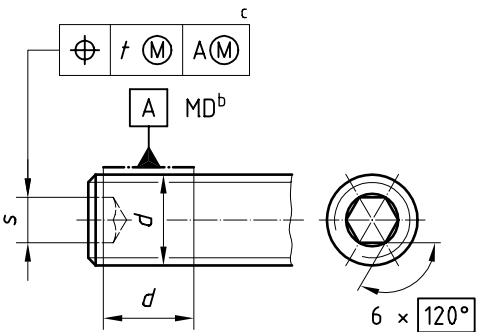
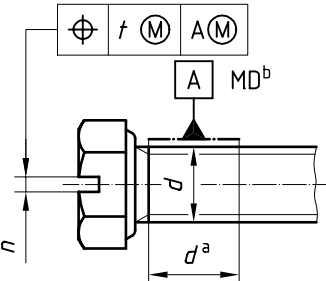
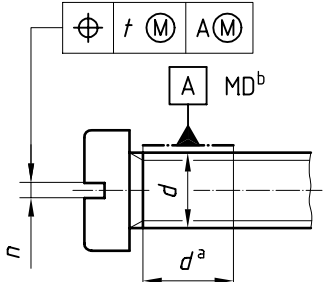
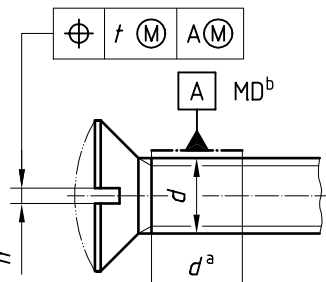
According to ISO 1101 when the datum is the thread axis the letters MD indicate that the datum reference is the major diameter axis.

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

| Feature                                                                                                                                                                                                                                                                                                                                                                            | Tolerance $t$ for product grades |   |   | Notes |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|---|---|-------|
|                                                                                                                                                                                                                                                                                                                                                                                    | A                                | B | C |       |
| <b>3.2.1 Driving feature</b><br><b>3.2.1.1 Tolerances of form</b><br><b>3.2.1.1.1 External</b><br> <p>a 3 × simultaneously.</p> <p><b>Figure 23</b></p>  <p>a 2 × simultaneously.</p> <p><b>Figure 24</b></p> |                                  |   |   |       |

| Feature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Tolerance $t$ for product grades |        |        | Tolerance $t$ based on dimensions | Notes                                                                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|--------|--------|-----------------------------------|--------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | A                                | B      | C      |                                   |                                                                                      |
| <b>3.2.1.1.2 Internal</b><br> <p>a 3 × simultaneously.</p> <p><b>Figure 25</b></p>                                                                                                                                                                                                                                                                                                                                                             |                                  |        |        |                                   |                                                                                      |
| <b>3.2.1.2 Tolerances of position</b><br> <p>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.</p> <p>b MD means that tolerance applies in relation to the axis of the cylinder derived from the major thread diameter.</p> <p>c 3 × simultaneously.</p> <p><b>Figure 26</b></p> | 2 IT13                           | 2 IT14 | 2 IT15 | s                                 |  |
|  <p>a, b, c See Figure 26.</p> <p><b>Figure 27</b></p>                                                                                                                                                                                                                                                                                                                                                                                       | 2 IT13                           | 2 IT14 | —      | s                                 |                                                                                      |

| Feature                                                                                                                                   | Tolerance $t$ for product grades |   |   | Tolerance $t$ based on dimensions | Notes |
|-------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|---|---|-----------------------------------|-------|
|                                                                                                                                           | A                                | B | C |                                   |       |
|  <p>a, b, c See Figure 26</p> <p><b>Figure 28</b></p>    | 2 IT13                           | — | — | $d$                               |       |
|  <p>a, b, c See Figure 26.</p> <p><b>Figure 29</b></p>  | 2 IT13                           | — | — | $d$                               |       |
|  <p>a, b, c See Figure 26.</p> <p><b>Figure 30</b></p> | 2 IT13                           | — | — | $d$                               |       |

| Feature                                                                                                                                | Tolerance $t$ for product grades |        |        | Tolerance $t$ based on dimensions | Notes |
|----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|--------|--------|-----------------------------------|-------|
|                                                                                                                                        | A                                | B      | C      |                                   |       |
|  <p>b, c See Figure 26.</p> <p><b>Figure 31</b></p>   | 2 IT12                           | —      | —      | $d$                               |       |
|  <p>a, b See Figure 26</p> <p><b>Figure 32</b></p>   | 2 IT12                           | 2 IT13 | 2 IT14 | $d$                               |       |
|  <p>a, b See Figure 26.</p> <p><b>Figure 33</b></p> | 2 IT12                           | 2 IT13 | 2 IT14 | $d$                               |       |
|  <p>a, b See Figure 26.</p> <p><b>Figure 34</b></p> | 2 IT12                           | 2 IT13 | 2 IT14 | $d$                               |       |