
Tolerances for fasteners —

Part 3:

**Plain washers for bolts, screws and nuts —
Product grades A and C**

Tolérances pour éléments de fixation —

Partie 3: Rondelles plates pour vis et écrous — Grades A et C



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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 734 10 79
E-mail copyright@iso.ch
Web www.iso.ch

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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 4759-3 was prepared by Technical Committee ISO/TC 2, *Fasteners*.

This third edition cancels and replaces the second edition (ISO 4759-3:1991), of 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 2: Bolts, screws and nuts with thread diameters from 1 up to 3 mm and product grade F, for fine mechanics*
- *Part 3: Plain washers for bolts, screws and nuts — Product grades A and C*

Annex A of this part of ISO 4759 is for information only.

Tolerances for fasteners —

Part 3:

Plain washers for bolts, screws and nuts — Product grades A and C

1 Scope

This part of ISO 4759 establishes a selection of tolerances for use in the preparation of ISO product standards for punched plain washers of product grades A and C, for use with bolts, screws and nuts of nominal thread diameters of from 1 mm to 150 mm inclusive.

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

NOTE The product grade refers to the quality of the product and to the size of the tolerances.

Annex A (informative) presents tolerances taken from ISO 286-1 and ISO 286-2.

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 1101—¹, *Geometrical product specifications (GPS) — Geometrical tolerancing — Tolerances of form, orientation, location and run-out.*

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

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

3 Tolerances

The tolerances for plain washers of product grades A and C are given in Table 1.

Unless otherwise specified, the tolerances specified in this part of ISO 4759 apply to washers prior to coating; see also ISO 4042.

1) To be published. (Revision of ISO 1101:1983)

Deviations from the tolerances specified in this part of ISO 4759 are permitted in product standards only for 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 latter takes precedence.

The tolerances of form and position are specified and indicated according to the definitions of ISO 1101 and ISO 2692.

Table 1

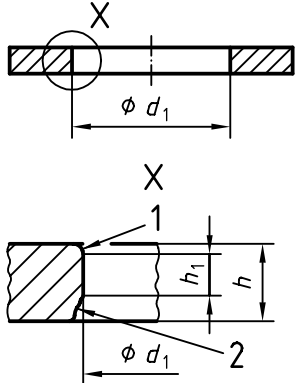
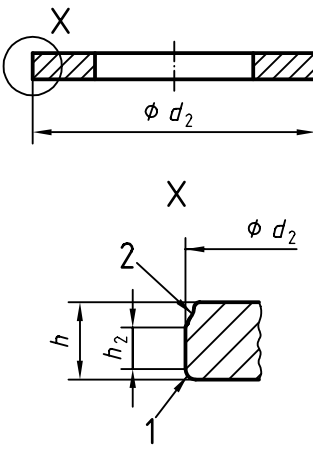
Feature	Tolerances				
	Product grades				
	A			C	
3.1 Clearance hole (punched)  Key 1 Rollover 2 Fracture	<i>h</i>	<i>d</i> ₁	<i>h</i> ₁	<i>h</i>	<i>d</i> ₁
	mm	tol.	min.	mm	tol.
	<i>h</i> ≤ 4 <i>h</i> > 4	H13 H14	0,5 <i>h</i> 0,3 <i>h</i>	<i>h</i> ≤ 4 <i>h</i> > 4	H14 H15
	Rollover and fracture are undefined but shall be present.			<i>h</i> ₁ , rollover and fracture are undefined but shall be present.	
	<i>h</i> ₁ is the part of the hole within the tolerance specified for <i>d</i> ₁ .				
3.2 Outside diameter (punched)  Key 1 Rollover 2 Fracture	<i>h</i>	<i>d</i> ₂		<i>d</i> ₂	
	mm	tol.		tol.	
	<i>h</i> ≤ 4 <i>h</i> > 4	h14 h15		h16	
	<i>h</i> ₂ , rollover and fracture are undefined but present. <i>h</i> ₂ is the part of the outer contour within the tolerance specified for <i>d</i> ₂ .				

Table 1 (continued)

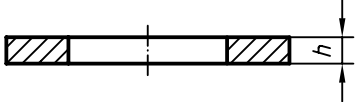
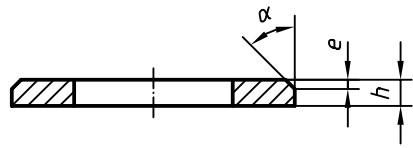
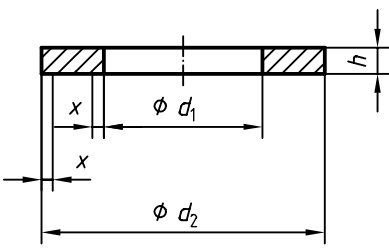
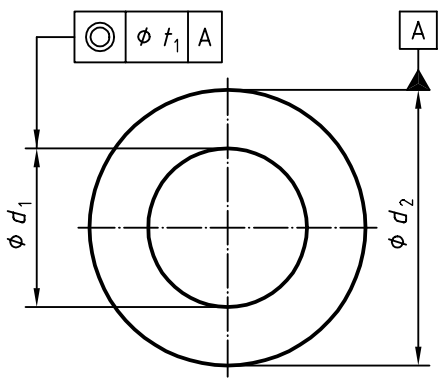
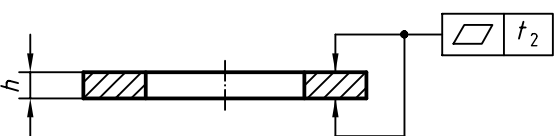
Feature	Tolerances			
	Product grades			
	A		C	
3.3 Thickness 	h mm	tol. mm	h mm	tol. mm
	$h \leq 0,5$ $0,5 < h \leq 1$ $1 < h \leq 2,5$ $2,5 < h \leq 4$ $4 < h \leq 6$ $6 < h \leq 10$ $10 < h \leq 20$	$\pm 0,05$ $\pm 0,1$ $\pm 0,2$ $\pm 0,3$ $\pm 0,6$ ± 1 $\pm 1,2$	$h \leq 0,5$ $0,5 < h \leq 1$ $1 < h \leq 2,5$ $2,5 < h \leq 4$ $4 < h \leq 6$ $6 < h \leq 10$ $10 < h \leq 20$	$\pm 0,1$ $\pm 0,2$ $\pm 0,3$ $\pm 0,6$ ± 1 $\pm 1,2$ $\pm 1,6$
3.4 Chamfer 	$\alpha = 30^\circ \text{ to } 45^\circ$ $e_{\min} = 0,25 h$ $e_{\max} = 0,5 h$			
3.5 Tolerances of form and position				
3.5.1 Thickness variation Δh on the same part  <p>NOTE Requirements for Δh apply at a distance of $x = 0,1 (d_2 - d_1)$ from the edge of the hole and the outer edge: i.e. only on 60 % of the ring width.</p>	h mm	Δh mm	(No requirements)	
	$h \leq 0,5$ $0,5 < h \leq 1$ $1 < h \leq 2,5$ $2,5 < h \leq 4$ $4 < h \leq 6$ $6 < h \leq 10$ $10 < h \leq 20$	0,025 0,05 0,1 0,15 0,2 0,3 0,4		

Table 1 (continued)

Feature	Tolerances				
	Product grades				
	A		C		
<p>3.5.2 Coaxiality</p>  <p>NOTE Tolerance t_1 is based on dimension d_2.</p>	d_2 mm	t_1	d_2 mm	t_1	
$d_2 \leq 50$ $d_2 > 50$	2 IT12 2 IT13	$d_2 \leq 50$ $d_2 > 50$	2 IT15 2 IT16		
<p>3.5.3 Flatness</p>  <p>NOTE Tolerance t_2 is always independent of the thickness tolerance for h.</p>	h mm	t_2^a mm	(No requirements)		
Stainless steel excepted					
$h \leq 0,5$ $0,5 < h \leq 1$ $1 < h \leq 2,5$ $2,5 < h \leq 4$ $4 < h \leq 6$ $6 < h \leq 10$ $10 < h \leq 20$	0,1 0,15 0,2 0,3 0,4 0,6 1				
Stainless steel					
$h \leq 0,5$ $0,5 < h \leq 1$ $1 < h \leq 2,5$ $2,5 < h \leq 4$ $4 < h \leq 6$ $6 < h \leq 10$ $10 < h \leq 20$	0,15 0,22 0,3 0,45 0,6 0,9 1,5				
<p>^a Flatness is measured after removal of burrs.</p>					

Annex A (informative)

Tolerances

Standard tolerance grades for IT values are given in table A.1 and the limit deviations for shafts and holes in tables A.2 and A.3, respectively. These tolerances are taken from ISO 286-1 and ISO 286-2.

Table A.1 — IT values of standard tolerance grades in millimetres

Nominal dimensions		Standard tolerance grades			
over	to	IT12	IT13	IT15	IT16
Tolerances					
	3	0,1	0,14	0,4	0,6
3	6	0,12	0,18	0,48	0,75
6	10	0,15	0,22	0,58	0,9
10	18	0,18	0,27	0,7	1,1
18	30	0,21	0,33	0,84	1,3
30	50	0,25	0,39	1	1,6
50	80	0,3	0,46	1,2	1,9
80	120	0,35	0,54	1,4	2,2
120	180	0,4	0,63	1,6	2,5
180	250	0,46	0,72	1,85	2,9

Table A.2 — Limit deviations for shafts

Nominal dimensions		Limit deviations		
mm		mm		
over	to	h14	h15	h16
	3	0 -0,25	0 -0,4	0 -0,6
3	6	0 -0,3	0 -0,48	0 -0,75
6	10	0 -0,36	0 -0,58	0 -0,9
10	18	0 -0,43	0 -0,7	0 -1,1
18	30	0 -0,52	0 -0,84	0 -1,3
30	50	0 -0,62	0 -1	0 -1,6
50	80	0 -0,74	0 -1,2	0 -1,9
80	120	0 -0,87	0 -1,4	0 -2,2
120	180	0 -1	0 -1,6	0 -2,5
180	250	0 -1,15	0 -1,85	0 -2,9

Table A.3 — Limit deviations for holes

Nominal dimensions		Limit deviations		
mm		mm		
over	to	H13	H14	H15
	3	+0,14 0	+0,25 0	+0,4 0
3	6	+0,18 0	+0,3 0	+0,48 0
6	10	+0,22 0	+0,36 0	+0,58 0
10	18	+0,27 0	+0,43 0	+0,7 0
18	30	+0,33 0	+0,52 0	+0,84 0
30	50	+0,39 0	+0,62 0	+1 0
50	80	+0,46 0	+0,74 0	+1,2 0
80	120	+0,54 0	+0,87 0	+1,4 0
120	180	+0,63 0	+1 0	+1,6 0
180	250	+0,72 0	+1,15 0	+1,85 0

Bibliography

- [1] ISO 286-1:1988, *ISO system of limits and fits — Part 1: Bases of tolerances, deviations and fits.*
- [2] ISO 286-2:1988, *ISO system of limits and fits — Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts.*

