

Metal washers
Technical delivery conditions

DIN
522

Scheiben aus metallischen Werkstoffen;
technische Lieferbedingungen

Supersedes August 1980 edition.

In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.

Dimensions in mm

1 Scope and field of application

This standard specifies requirements for metal washers manufactured by stamping (punching) which thus exhibit inside and outside rollover and fracture (cf. DIN 6930 Part 2 and DIN 6932). It does not cover washers manufactured by machining (e.g. by drilling or turning).

This standard specifies tolerances and limit deviations for washers the preferred application of which is in bolt/nut assemblies. These tolerances are to be used in standards dealing with product grades F, A and C washers designed for bolts, screws and nuts with nominal thread diameters from 1 mm to 160 mm.

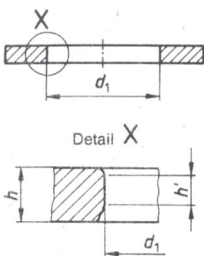
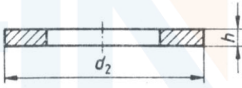

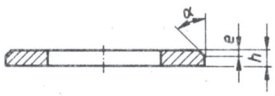
In product standards, deviations from the tolerances specified here are permitted only where technical reasons so require. It is recommended that these tolerances also be used for non-standard washers. In cases where the maximum material principle as described in ISO 2692 applies, tolerances other than specified may be used.

Continued on pages 2 to 6

2 Dimensional tolerances and limit deviations

Products grades F, A and C washers shall be produced to the dimensional tolerances given in table 1.

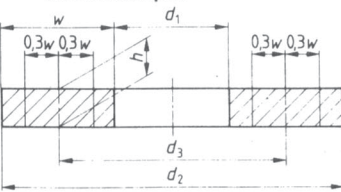
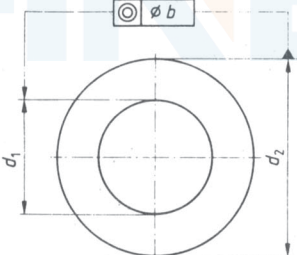
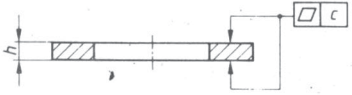
Table 1.

Characteristic	Tolerances					
	Product grade					
	F		A		C	
2.1 Clearance hole diameter 	<i>h</i>	<i>d</i> ₁	<i>h</i>	<i>d</i> ₁	<i>h</i>	<i>d</i> ₁
	≤ 4	H12	≤ 4	H13	≤ 4	H14
	> 4	H13	> 4	H14	> 4	H15
	<i>h</i>	<i>h</i> ' 1) min	<i>h</i>	<i>h</i> ' 1) min	<i>h</i>	<i>h</i> ' min
	≤ 4	0,5 <i>h</i>	≤ 4	0,5 <i>h</i>	Undefined.	
	> 4	0,3 <i>h</i>	> 4	0,3 <i>h</i>		
2.2 Outside diameter 	<i>h</i>	<i>d</i> ₂	<i>h</i>	<i>d</i> ₂	<i>h</i>	<i>d</i> ₂
	≤ 4	h13	≤ 4	h14	≤ 4	h16
	> 4	h14	> 4	h15	> 4	h16
2.3 Thickness 	<i>h</i>	Limit deviations	<i>h</i>	Limit deviations	<i>h</i>	Limit deviations
	≤ 0,5	± 0,04	≤ 0,5	± 0,05	-	-
	> 0,5 ≤ 1	± 0,06	> 0,5 ≤ 1	± 0,1	≤ 1	± 0,2
	> 1 ≤ 2,5	± 0,12	> 1 ≤ 2,5	± 0,2	> 1 ≤ 2,5	± 0,3
	> 2,5 ≤ 4	± 0,16	> 2,5 ≤ 4	± 0,3	> 2,5 ≤ 4	± 0,6
	> 4 ≤ 6	± 0,2	> 4 ≤ 6	± 0,6	> 4 ≤ 6	± 1
	> 6 ≤ 10	± 0,24	> 6 ≤ 10	± 1	> 6 ≤ 10	± 1,2
	> 10 ≤ 20	± 0,28	> 10 ≤ 20	± 1,2	> 10 ≤ 20	± 1,6
2.4 Chamfer 	$\alpha = 30^\circ \text{ to } 45^\circ$ $e_{\min} = 0,25 h$ $e_{\max} = 0,5 h$				Undefined.	
1) The tolerances specified for <i>d</i> ₁ apply only to the straight part of the hole represented by <i>h</i> '.						

3 Geometrical tolerances

Product grades F, A and C washers shall be produced to the geometrical tolerances given in table 2.

Table 2.

Characteristic	Tolerances					
	Product grade					
	F		A		C	
<p>3.1 Thickness variation on the same part</p>  <p> $w = \frac{1}{2} (d_2 - d_1)$ $d_3 = \frac{d_1 + d_2}{2}$ </p>	<i>h</i>	Δh	<i>h</i>	Δh	<i>h</i>	Δh
	$\leq 0,5$	0,02	$\leq 0,5$	0,025	Undefined.	
	$> 0,5 \leq 1$	0,03	$> 0,5 \leq 1$	0,05		
	$> 1 \leq 2,5$	0,06	$> 1 \leq 2,5$	0,1		
	$> 2,5 \leq 4$	0,08	$> 2,5 \leq 4$	0,15		
	$> 4 \leq 6$	0,1	$> 4 \leq 6$	0,2		
	$> 6 \leq 10$	0,12	$> 6 \leq 10$	0,3		
	$> 10 \leq 20$	0,14	$> 10 \leq 20$	0,4		
	The requirements for Δh apply only for a zone defined by $d_2 - 0,3 w$ and $d_3 + 0,3 w$.					
	<p>3.2 Coaxiality</p>  <p>Tolerance <i>b</i> is based on outside diameter d_2.</p>	d_2	<i>b</i>	d_2	<i>b</i>	d_2
≤ 50		2 IT11	≤ 50	2 IT12	≤ 50	2 IT15
> 50		2 IT12	> 50	2 IT13	> 50	2 IT16
<p>3.3 Flatness</p>  <p>Tolerance <i>c</i> is not a function of the tolerance on <i>h</i>.</p>	<i>h</i>	<i>c</i> ¹⁾	<i>h</i>	<i>c</i> ¹⁾	<i>h</i>	<i>c</i>
	$\leq 0,5$	0,07	$\leq 0,5$	0,1	Undefined.	
	$> 0,5 \leq 1$	0,1	$> 0,5 \leq 1$	0,15		
	$> 1 \leq 2,5$	0,2	$> 1 \leq 2,5$	0,2		
	$> 2,5 \leq 4$	0,3	$> 2,5 \leq 4$	0,3		
	$> 4 \leq 6$	0,4	$> 4 \leq 6$	0,4		
	$> 6 \leq 10$	0,6	$> 6 \leq 10$	0,6		
	$> 10 \leq 20$	1	$> 10 \leq 20$	1		
1) For washers made from stainless steel, the maximum permissible flatness tolerance shall be equal to 2 <i>c</i> .						

4 Burr

Washer shall be free from burr.

5 Surface condition

5.1 Surface roughness

Table 3. **Roughness**

Surfaces	<i>h</i>	Maximum surface roughness, in μm					
		Product grade					
		F		A		C	
		R_a	$R_z^{(1)}$	R_a	$R_z^{(1)}$	R_a	$R_z^{(1)}$
Bearing surfaces	≤ 3	1,6	6,3	1,6	6,3	Undefined.	
	$> 3 \leq 6$	3,2	12,5	3,2	12,5		
	> 6	6,3	25	6,3	25		
Side faces	≤ 20	25	100	Undefined.			

1) For information only; see Explanatory notes.

5.2 Electroplating

DIN 267 Part 9 shall apply with regard to electroplating.

5.3 Hot-dip galvanizing

DIN 267 Part 10 shall apply with regard to hot-dip galvanizing.

6 Packaging

The washers shall be packed so as to prevent any mechanical or corrosion damage during transit.

The packaging of standard washers shall be marked with the symbol specified in the relevant standard and, unless otherwise agreed, with the number of items and the manufacturer's symbol.

7 Acceptance inspection

Acceptance inspection of washers shall be carried out on the lines of DIN 267 Part 5.

7.1 Dimensional accuracy

Table 4 shall apply with regard to the major characteristics to be inspected and table 5, with regard to the acceptable quality level, *AQL*. For minor characteristics, *AQL* 4 shall apply.

Table 4. **Major characteristics**

Major characteristics
Clearance hole diameter
Outside diameter
Thickness
Thickness variation on the same part
Coaxiality

Table 5. *AQL* values for major characteristics

Product grade	<i>AQL</i>
F	0,65
A and C	1,5

Appendix A

A.1 Fundamental tolerances and tolerance zones

Table A.1.

Nominal size		Fundamental tolerances						Tolerance zones ¹							
Over	Up to	IT11	IT12	IT13	IT14	IT15	IT16	Outside dimensions				Inside dimensions			
								h13	h14	h15	h16	H12	H13	H14	H15
-	3	0,06	0,10	0,14	0,25	0,40	0,60	0 -0,14	0 -0,25	0 -0,40	0 -0,60	+0,10 0	+0,14 0	+0,25 0	+0,40 0
3	6	0,075	0,12	0,18	0,30	0,48	0,75	0 -0,18	0 -0,30	0 -0,48	0 -0,75	+0,12 0	+0,18 0	+0,30 0	+0,48 0
6	10	0,09	0,15	0,22	0,36	0,58	0,90	0 -0,22	0 -0,36	0 -0,58	0 -0,90	+0,15 0	+0,22 0	+0,36 0	+0,58 0
10	18	0,11	0,18	0,27	0,43	0,70	1,10	0 -0,27	0 -0,43	0 -0,70	0 -1,10	+0,18 0	+0,27 0	+0,43 0	+0,70 0
18	30	0,13	0,21	0,33	0,52	0,84	1,30	0 -0,33	0 -0,52	0 -0,84	0 -1,30	+0,21 0	+0,33 0	+0,52 0	+0,84 0
30	50	0,16	0,25	0,39	0,62	1,00	1,60	0 -0,39	0 -0,62	0 -1,00	0 -1,60	+0,25 0	+0,39 0	+0,62 0	+1,00 0
50	80	0,19	0,30	0,46	0,74	1,20	1,90	0 -0,46	0 -0,74	0 -1,20	0 -1,90	+0,30 0	+0,46 0	+0,74 0	+1,20 0
80	120	0,22	0,35	0,54	0,87	1,40	2,20	0 -0,54	0 -0,87	0 -1,40	0 -2,20	+0,35 0	+0,54 0	+0,87 0	+1,40 0
120	180	0,25	0,40	0,63	1,00	1,60	2,50	0 -0,63	0 -1,00	0 -1,60	0 -2,50	+0,40 0	+0,63 0	+1,00 0	+1,60 0
180	250	0,29	0,46	0,72	1,15	1,85	2,90	0 -0,72	0 -1,15	0 -1,85	0 -2,90	+0,46 0	+0,72 0	+1,15 0	+1,85 0

Standards referred to

DIN 267 Part 5	Fasteners; technical delivery conditions; acceptance inspection (modified version of ISO 3269, 1984 edition)
DIN 267 Part 9	Fasteners; technical delivery conditions; electroplated fasteners
DIN 267 Part 10	Fasteners; technical delivery conditions; hot-dip galvanized components
DIN 6930 Part 2	Steel stampings; general tolerances
DIN 6932	Rules for designing steel stampings
ISO 2692: 1988	Technical drawings; geometrical tolerancing; maximum material principle

Previous editions

DIN 522: 10.44, 01.54, 04.68, 06.74, 09.75, 08.80.

Amendments

The following amendments have been made to the August 1980 edition.

- a) Scope and field of application have been redefined.
- b) h' values have been specified for the first time.
- c) The permissible thickness variation on the same part has been specified instead of the parallelism tolerance.
- d) Requirements for flatness have been specified instead of those for camber.
- e) For product grade C washers, specifications for h' , the thickness variation on the same part and the surface roughness are no longer included.
- f) The surface roughness specifications have been revised and parameter R_a introduced.
- g) Specifications for freedom from burr have been included.
- h) The specifications regarding acceptance inspection have been harmonized with those given in DIN 267 Part 5.
- i) The standard has been editorially revised.

Explanatory notes

The specifications of this standard are essentially in agreement with those for dimensional and geometrical tolerances to be included in a revised edition of International Standard ISO 4759-3: 1977*), currently being prepared.

In addition to the specifications given in ISO 4759-3, DIN 522 specifies tolerances and limit deviations for product grade F washers and gives specifications regarding freedom from burr and surface roughness and finish of washers. It is intended to adopt these specifications in a revised edition of the ISO Standard.

In keeping with international practice, R_a has been introduced as the relevant surface roughness parameter and the permissible surface roughness reduced in accordance with the current specifications for semi-finished products. R_z values have been given for information purposes.

International Patent Classification

F 16 B 43/00

*) Obtainable from *Beuth Verlag GmbH (Auslandsnormenverkauf)*, Burggrafenstraße 6, D-1000 Berlin 30.