National foreword

This standard has been prepared by Technical Committee CEN/TC 132 “Aluminium and aluminium alloys” (Secretariat: AFNOR, France), Working Group WG 5 “Extruded and drawn products” (Secretariat: SN, Norway).

The responsible German body involved in its preparation was the *Normenausschuss Nichteisenmetalle* (Nonferrous Metals Standards Committee), Technical Committee NA 066-01-04 AA *Strangpresserzeugnisse*.

Amendments

This standard differs from DIN EN 755-9:2001-07 as follows:

a) In Table 1 “Alloy groups”, alloys EN AW-3102, EN AW-6010A, EN AW-6023 and EN AW-6360 have been added in Group I and alloys EN AW-3102, EN AW-6008, EN AW-6010A and EN AW-6023 and EN AW-6360 have been added in Group II.

b) In subclause 4.3, Figure 6 has been added to illustrate the measurements of convexity-concavity in hollow sections.

c) The standard has been editorially revised.

Previous editions

DIN 1748-4: 1962-05, 1968-12, 1981-11
DIN 9711: 1941-11, 1955-09
DIN EN 755-9: 2001-07

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English Version

Aluminium and aluminium alloys - Extruded rod/bar, tube and profiles - Part 9: Profiles, tolerances on dimensions and form

Aluminium et alliages d'aluminium - Barres, tubes et profilés filés - Partie 9: Profilés, tolérances sur dimensions et forme

Aluminium und Aluminiumlegierungen - Stranggepresste Stangen, Rohre und Profile - Teil 9: Profile, Grenzabmaße und Formtoleranzen

This European Standard was approved by CEN on 10 February 2008.

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Foreword

This document (EN 755-9:2008) has been prepared by Technical Committee CEN/TC 132 “Aluminium and aluminium alloys”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2008, and conflicting national standards shall be withdrawn at the latest by September 2008.

This document supersedes EN 755-9:2001.

Within its programme of work, Technical committee CEN/TC 132 entrusted CEN/TC 132/WG 5 "*Extruded and drawn products*" to revise EN 755-9:2001.

The following technical modifications have been introduced during the revision:

— Clause 2: Alloys EN AW-3102, EN AW-6010A, EN AW-6023 and EN AW-6360 are added in Group I

— Clause 2: Alloys EN AW-5049, EN AW-6014, EN AW-6262A, EN AW-6065, EN AW-6182, EN AW-7108, EN AW-7108A and EN AW-7021 are added in Group II

— Subclause 4.3: Figure 6 is added to illustrate the measurements of convexity-concavity in hollow sections

EN 755 comprises the following parts under the general title "*Aluminium and aluminium alloys — Extruded rod/bar, tube and profiles*":

— *Part 1: Technical conditions for inspection and delivery*

— *Part 2: Mechanical properties*

— *Part 3: Round bars, tolerances on dimensions and form*

— *Part 4: Square bars, tolerances on dimensions and form*

— *Part 5: Rectangular bars, tolerances on dimensions and form*

— *Part 6: Hexagonal bars, tolerances on dimensions and form*

— *Part 7: Seamless tubes, tolerances on dimensions and form*

— *Part 8: Porthole tubes, tolerances on dimensions and form*

— *Part 9: Profiles, tolerances on dimensions and form*

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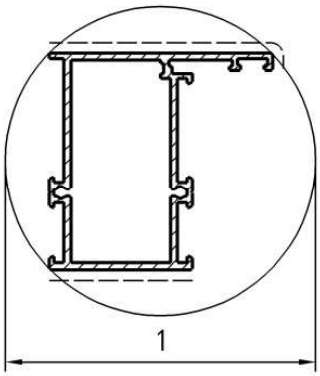
1 Scope

This document specifies the tolerances on dimensions and form for aluminium and aluminium alloy extruded profile with a cross section contained within a circumscribing circle not greater than 800 mm (see Figure 1).

The temper designations used in this part are according to EN 515.

This standard applies to extruded profiles for general engineering applications only.



Key

1 circumscribing circle $CD \leq 800$ mm

Figure 1 — Circumscribing circle

2 Alloy groups

For the purpose of this document, the alloys are distributed into two groups which correspond to varying degrees of difficulty when manufacturing the products.

The division into group I and group II of the most commonly used general engineering alloys is specified in Table 1. Grouping of other alloys is subject to agreement between supplier and purchaser.

Table 1 — Alloy groups

Group I	EN AW-1050A, EN AW-1070A, EN AW-1200, EN AW-1350 EN AW-3102, EN AW-3003, EN AW-3103 EN AW-5005, EN AW-5005A EN AW-6101A, EN AW-6101B, EN AW-6005, EN AW-6005A, EN AW-6106, EN AW-6008, EN AW-6010A, EN AW-6023, EN AW-6060, EN AW-6360, EN AW-6063, EN AW-6063A, EN AW-6463
Group II	EN AW-2007, EN AW-2011, EN AW-2011A, EN AW-2014, EN AW-2014A, EN AW-2017A, EN AW-2024, EN AW-2030 EN AW-5019, EN AW-5049, EN AW-5051A, EN AW-5251, EN AW-5052, EN AW-5154A, EN AW-5454, EN AW-5754, EN AW-5083, EN AW-5086 EN AW-6012, EN AW-6014, EN AW-6018, EN AW-6351, EN AW-6061, EN AW-6261, EN AW-6262, EN AW-6262A, EN AW-6065, EN AW-6081, EN AW-6082, EN AW-6182 EN AW-7003, EN AW-7005, EN AW-7108, EN AW-7108A, EN AW-7020, EN AW-7021, EN AW-7022, EN AW-7049A, EN AW-7075

3 Tolerances on dimensions

3.1 Cross-sectional dimensions

3.1.1 General

The tolerances on the dimensions listed below (see Figures 2, 3 and 4) are specified in the relevant Tables 2 to 9.

— A: wall thicknesses except those enclosing the hollow spaces in hollow profiles;

— B: wall thicknesses enclosing the hollow spaces in hollow profiles except those between two hollow spaces;

— C: wall thicknesses between two hollow spaces in hollow profiles;

— E: the length of the shorter leg of profiles with open ends;

— H: all dimensions (except wall thickness) between points on the cross section of the profile or the centres of open screw holes.

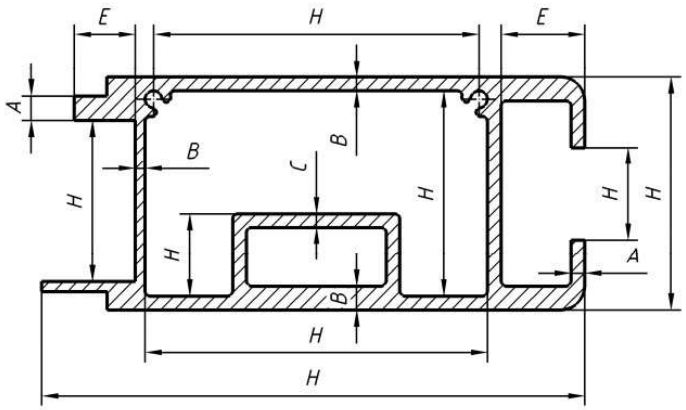


Figure 2 — Definition of dimensions *A, B, C, E, H*

3.1.2 Tolerances on dimensions other than wall thickness

The tolerances on dimensions shall be as specified in Tables 2 and 3. For profiles with open ends (see Figures 3, 4 and the relevant examples) the tolerances specified in Table 4 shall be added to those of Tables 2 and 3 for dimension H across open ended legs in order to obtain the tolerances on the gap between any opposite points on these ends.

Table 2 — Tolerances on cross-sectional dimensions of solid and hollow profiles - Alloy group I

Dimensions in millimetres

Dimension H		Tolerances on H for circumscribing circle CD [a] [b]				
Over	Up to and including	$CD \leq 100$	$100 < CD \leq 200$	$200 < CD \leq 300$	$300 < CD \leq 500$	$500 < CD \leq 800$
-	10	± 0,25	± 0,30	± 0,35	± 0,40	± 0,50
10	25	± 0,30	± 0,40	± 0,50	± 0,60	± 0,70
25	50	± 0,50	± 0,60	± 0,80	± 0,90	± 1,0
50	100	± 0,70	± 0,90	± 1,1	± 1,3	± 1,5
100	150	-	± 1,1	± 1,3	± 1,5	± 1,7
150	200	-	± 1,3	± 1,5	± 1,8	± 2,0
200	300	-	-	± 1,7	± 2,1	± 2,4
300	450	-	-	-	± 2,8	± 3,0
450	600	-	-	-	± 3,8	± 4,2
600	800	-	-	-	-	± 5,0

[a] These tolerances do not apply to tempers O and Tx510. For these tempers, the tolerances shall be subject to agreement between supplier and purchaser.
[b] For profiles with open ends, see Figures 3 and 4, the tolerances for *H* in the area of the open ends shall be increased by the values specified in Table 4.

Table 3 — Tolerances on cross-sectional dimensions of solid and hollow profiles - Alloy group II

Dimensions in millimetres

Dimension H		Tolerances on H for circumscribing circle CD [a] [b]				
Over	Up to and including	$CD \leq 100$	$100 < CD \leq 200$	$200 < CD \leq 300$	$300 < CD \leq 500$	$500 < CD \leq 800$
-	10	± 0,40	± 0,50	± 0,55	± 0,60	± 0,70
10	25	± 0,50	± 0,70	± 0,80	± 0,90	± 1,1
25	50	± 0,80	± 0,90	± 1,0	± 1,2	± 1,3
50	100	± 1,0	± 1,2	± 1,3	± 1,6	± 1,8
100	150	-	± 1,5	± 1,7	± 1,8	± 2,0
150	200	-	± 1,9	± 2,2	± 2,4	± 2,7
200	300	-	-	± 2,5	± 2,8	± 3,1
300	450	-	-	-	± 3,5	± 3,8
450	600	-	-	-	± 4,5	± 5,0
600	800	-	-	-	-	± 6,0

[a] These tolerances do not apply to tempers O and Tx510. For these tempers, the tolerances shall be subject to agreement between supplier and purchaser.

[b] For profiles with open ends, see Figures 3 and 4, the tolerances for H in the area of the open ends shall be increased by the values specified in Table 4.

Table 4 — Additions to the tolerances on cross-sectional dimensions H of solid and hollow profiles with open ends - Alloy groups I and II

Dimensions in millimetres

Dimension E		Additions to the tolerances on H in Tables 2 and 3 for dimensions across the ends of open ended profiles
Over	Up to and including	
-	20	-
20	30	± 0,15
30	40	± 0,25
40	60	± 0,40
60	80	± 0,50
80	100	± 0,60
100	125	± 0,80
125	150	± 1,0
150	180	± 1,2
180	210	± 1,4
210	250	± 1,6
250	-	± 1,8

Figures 3 and 4 below show open ends on hollow and solid profiles. The determination of tolerances on cross-sectional dimensions *H* is shown in the following calculation examples 1 and 2.

Examples of tolerance calculations across open ended profiles.

EXAMPLE 1

Dimension H: 20 mm

Dimension E: 100 mm Circumscribing circle CD 100 mm to 200 mm Alloy group I

The tolerance on H according to Table 2 is ± 0,40 mm; plus the additional tolerance according to Table 4 which is ± 0,60 mm; total tolerance on H is ± 1,0 mm.

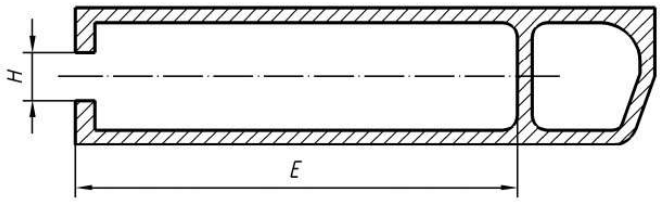


Figure 3 — Hollow profile with open end

EXAMPLE 2

Dimension H: 40 mm

Dimension E: 50 mm Circumscribing circle CD 100 mm to 200 mm Alloy group II

The tolerance on H according to Table 3 is ± 0,90 mm; plus the additional tolerance according to Table 4 which is ± 0,40 mm; total tolerance on H is ± 1,3 mm.

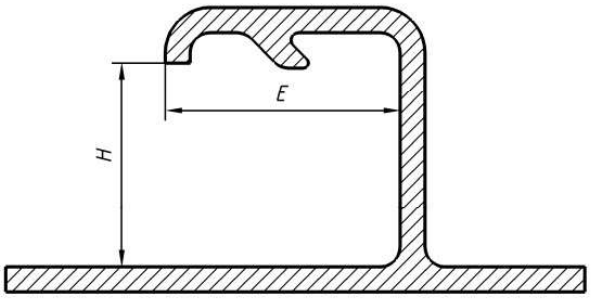


Figure 4 — Solid profile with open end

3.1.3 Tolerances on wall thickness of solid and hollow profiles

The tolerances on wall thickness of solid and hollow profiles shall be as specified in Tables 5, 6, 7 and 8.

Table 5 — Tolerances on wall thickness for profiles with a circumscribing circle up to and including 300 mm - Alloy group I

Dimensions in millimetres

Nominal wall thickness *A*, *B* or *C*		Tolerances on wall thickness					
		Wall thickness *A* Circumscribing circle		Wall thickness *B* [a] Circumscribing circle		Wall thickness *C* Circumscribing circle	
Over	Up to and including	$CD \leq 100$	$100 < CD \leq 300$	$CD \leq 100$	$100 < CD \leq 300$	$CD \leq 100$	$100 < CD \leq 300$
-	1,5	± 0,15	± 0,20	± 0,20	± 0,30	± 0,25	± 0,35
1,5	3	± 0,15	± 0,25	± 0,25	± 0,40	± 0,30	± 0,50
3	6	± 0,20	± 0,30	± 0,40	± 0,60	± 0,50	± 0,75
6	10	± 0,25	± 0,35	± 0,60	± 0,80	± 0,75	± 1,0
10	15	± 0,30	± 0,40	± 0,80	± 1,0	± 1,0	± 1,2
15	20	± 0,35	± 0,45	± 1,2	± 1,5	± 1,5	± 1,9
20	30	± 0,40	± 0,50	± 1,5	± 1,8	± 1,9	± 2,2
30	40	± 0,45	± 0,60	-	± 2,0	-	± 2,5
40	50	-	± 0,70	-	-	-	-

[a] For seamless hollow profiles the tolerances given for wall thickness *C* shall apply.

Table 6 — Tolerances on wall thickness for profiles with a circumscribing circle over 300 mm – Alloy group I

Dimensions in millimetres

Nominal wall thickness *A*, *B* or *C*		Tolerances on wall thickness					
		Wall thickness *A* Circumscribing circle		Wall thickness *B* [a] Circumscribing circle		Wall thickness *C* Circumscribing circle	
Over	Up to and including	300 < *CD* ≤ 500	500 < *CD* ≤ 800	300 < *CD* ≤ 500	500 < *CD* ≤ 800	300 < *CD* ≤ 500	500 < *CD* ≤ 800
-	1,5	± 0,25	-	-	-	-	-
1,5	3	± 0,35	± 0,40	± 0,60	± 0,80	± 0,75	± 1,0
3	6	± 0,40	± 0,50	± 0,80	± 1,0	± 1,0	± 1,2
6	10	± 0,45	± 0,55	± 1,0	± 1,2	± 1,2	± 1,5
10	15	± 0,50	± 0,60	± 1,2	± 1,5	± 1,5	± 1,9
15	20	± 0,55	± 0,65	± 1,7	± 2,0	± 2,0	± 2,5
20	30	± 0,60	± 0,70	± 2,0	± 2,5	± 2,5	± 3,0
30	40	± 0,70	± 0,80	± 2,2	± 2,7	± 2,7	± 3,3
40	50	± 0,80	± 0,90	-	-	-	-

[a] For seamless hollow profiles the tolerances given for wall thickness *C* shall apply.

Table 7 — Tolerances on wall thickness for profiles with a circumscribing circle up to and including 300 mm - Alloy group II

Dimensions in millimetres

Nominal wall thickness *A*, *B* or *C*		Tolerances on wall thickness					
		Wall thickness *A* Circumscribing circle		Wall thickness *B* [a] Circumscribing circle		Wall thickness *C* Circumscribing circle	
Over	Up to and including	*CD* ≤ 100	100 < *CD* ≤ 300	*CD* ≤ 100	100 < *CD* ≤ 300	*CD* ≤100	100 < *CD* ≤ 300
-	1,5	± 0,20	± 0,25	± 0,30	± 0,40	± 0,35	± 0,50
1,5	3	± 0,25	± 0,30	± 0,35	± 0,50	± 0,45	± 0,65
3	6	± 0,30	± 0,35	± 0,55	± 0,70	± 0,60	± 0,90
6	10	± 0,35	± 0,45	± 0,75	± 1,0	± 1,0	± 1,3
10	15	± 0,40	± 0,50	± 1,0	± 1,3	± 1,3	± 1,7
15	20	± 0,45	± 0,55	± 1,5	± 1,8	± 1,9	± 2,2
20	30	± 0,50	± 0,60	± 1,8	± 2,2	± 2,2	± 2,7
30	40	± 0,60	± 0,70	-	± 2,5	-	-
40	50	-	± 0,80	-	-	-	-

[a] For seamless hollow profiles the tolerances given for wall thickness *C* shall apply.

Table 8 — Tolerances on wall thickness for profiles with a circumscribing circle over 300 mm – Alloy group II

Dimensions in millimetres

Nominal wall thickness *A*, *B* or *C*		Tolerances on wall thickness					
		Wall thickness *A* Circumscribing circle		Wall thickness *B* [a] Circumscribing circle		Wall thickness *C* Circumscribing circle	
Over	Up to and including	300 < *CD* ≤ 500	500 < *CD* ≤ 800	300 < *CD* ≤ 500	500 < *CD* ≤ 800	300 < *CD* ≤ 500	500 < *CD* ≤ 800
-	1,5	± 0,35	-	-	-	-	-
1,5	3	± 0,45	± 0,50	± 0,70	± 0,90	± 0,90	± 1,2
3	6	± 0,60	± 0,60	± 0,90	±1,0	± 1,2	± 1,3
6	10	± 0,65	± 0,70	± 1,2	± 1,5	± 1,5	± 1,9
10	15	± 0,70	± 0,80	± 1,5	± 1,8	± 1,9	± 2,3
15	20	± 0,75	± 0,85	± 2,0	± 2,5	± 2,3	± 3,1
20	30	± 0,80	± 0,90	± 2,5	± 3,0	± 3,1	± 3,7
30	40	± 0,90	± 1,0	± 3,0	± 3,2	-	-
40	50	± 1,0	± 1,1	-	-	-	-

[a] For seamless hollow profiles the tolerances given for wall thickness *C* shall apply.

3.2 Length

If fixed lengths are to be supplied, this shall be stated in the order document. The tolerances on fixed length shall be specified in Table 9.

Table 9 — Tolerances on fixed length

Dimensions in millimetres

Circumscribing circle diameter *CD*		Tolerances on fixed length *L*				
Over	Up to and including	*L* ≤ 2 000	2 000 < *L* ≤ 5 000	5 000 < *L* ≤10 000	10 000 < *L* ≤ 15 000	15 000 < *L* ≤ 25 000
-	100	+5 0	+7 0	+10 0	+16 0	+22 0
100	200	+7 0	+9 0	+12 0	+18 0	+24 0
200	450	+8 0	+11 0	+14 0	+20 0	+28 0
450	800	+9 0	+14 0	+16 0	+22 0	+30 0

If no fixed length is specified in the order document, profiles may be delivered in random lengths.

The length range and the tolerances on the random length shall be subject to agreement between supplier and purchaser.

3.3 Squareness of cut ends

The squareness of cut ends shall be within half of the fixed length tolerance range specified in Table 9 for both fixed and random length (e.g. for a fixed length tolerance of $^{+10}_{0}$ mm, the squareness of cut ends shall be within 5 mm).

4 Tolerances on form

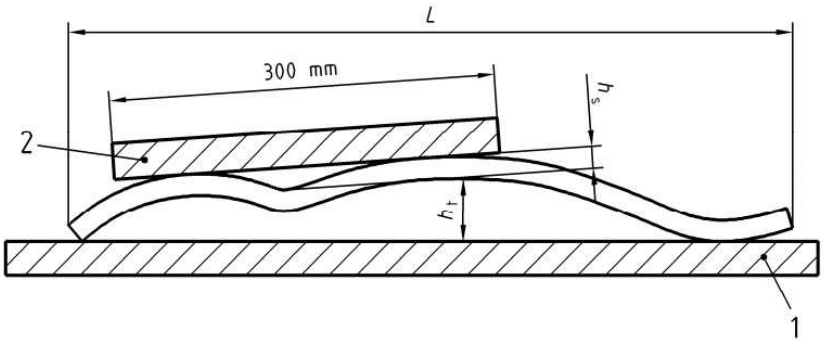
4.1 General

Tolerances on form for O and Tx510 tempers shall be subject to agreement between supplier and purchaser.

4.2 Straightness

Deviations from straightness, h_s and h_t, shall be measured as shown in Figure 5 with the profile placed on a horizontal base plate so that its own mass decreases the deviation.

The straightness tolerance h_t shall not exceed 1,5 mm/m length (e.g. 9 mm maximum deviation for a 6 m length). Local deviations h_s from straightness shall not exceed 0,6 mm/300 mm length.



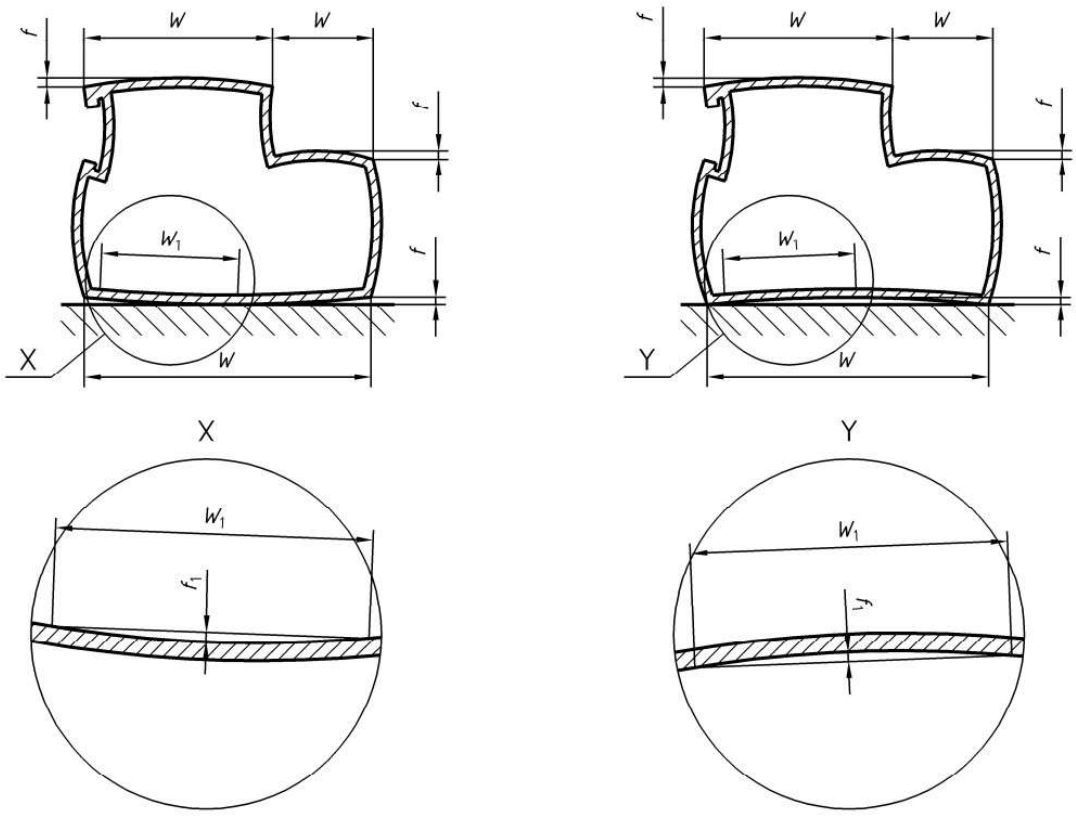
Key

1 base plate
2 straight edge

Figure 5 — Measurement of deviation from straightness

4.3 Convexity-Concavity

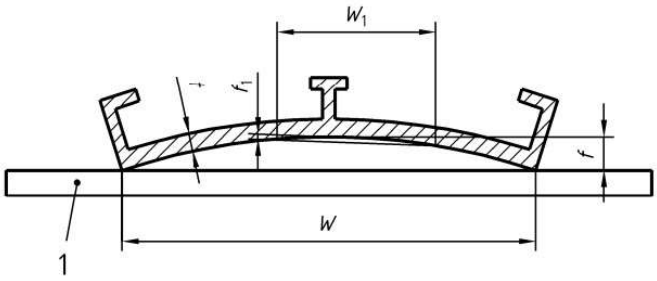
The convexity-concavity shall be measured as shown in Figure 6 and 7. The maximum allowable deviation on convexity-concavity for solid and hollow profiles shall be as specified in Table 10 as a function of profile width W and thickness t.



Key

W = Width
f = Deviation
W_1 = 100 mm
f_1 = local deviation per any 100 mm

Figure 6 — Measurement of convexity - concavity for hollow sections



Key

1 base plate
W = width
f = deviation
W_1 = 100 mm
f_1 = local deviation per any 100 mm

Figure 7 — Measurement of convexity – concavity for open section

Table 10 — Convexity - concavity tolerances

Dimensions in millimetres

Width W		Deviation f		
		Hollow profiles [a]		Solid profiles
Over	Up to and including	Wall thickness $t \leq 5$	Wall thickness $t > 5$	
-	30	0,30	0,20	0,20
30	60	0,40	0,30	0,30
60	100	0,60	0,40	0,40
100	150	0,90	0,60	0,60
150	200	1,2	0,80	0,80
200	300	1,8	1,2	1,2
300	400	2,4	1,6	1,6
400	500	3,0	2,0	2,0
500	600	3,6	2,4	2,4
600	800	4,0	3,0	3,0

[a] If the profile has varying wall thicknesses in the measurement range, the thinnest wall thickness shall be used.

In the case of solid and hollow profiles with a width W of at least 150 mm, the local deviation f_1, shall not exceed 0,7 mm for any 100 mm of width W_1.

4.4 Contour

For profiles with curved cross sections, the deviation at any point of the curve from the theoretically exact line as defined by the drawing, shall not be greater than the appropriate tolerance C specified in Table 11. Considering all points on the curve, a tolerance zone shall be defined as the zone between two envelopes running tangentially to all circles of diameter C which can be drawn with their centres lying along the theoretically exact line; this is shown in Figure 8.

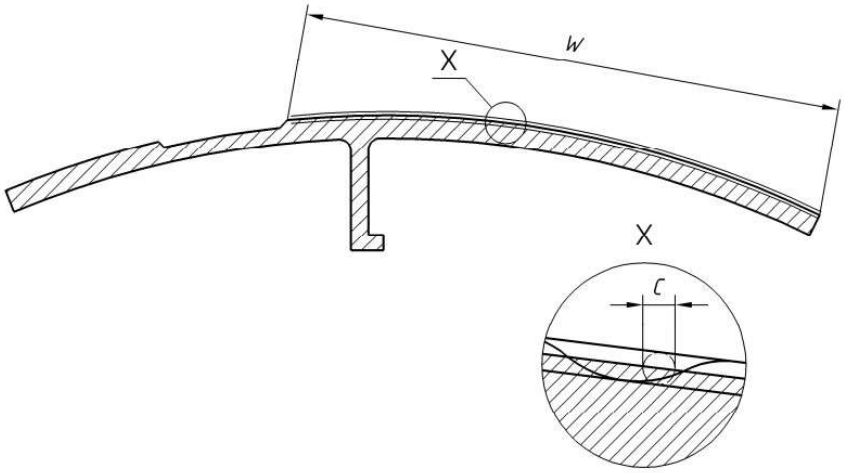


Figure 8 — Definition of contour tolerances

Table 11 — Contour tolerances

Dimensions in millimetres

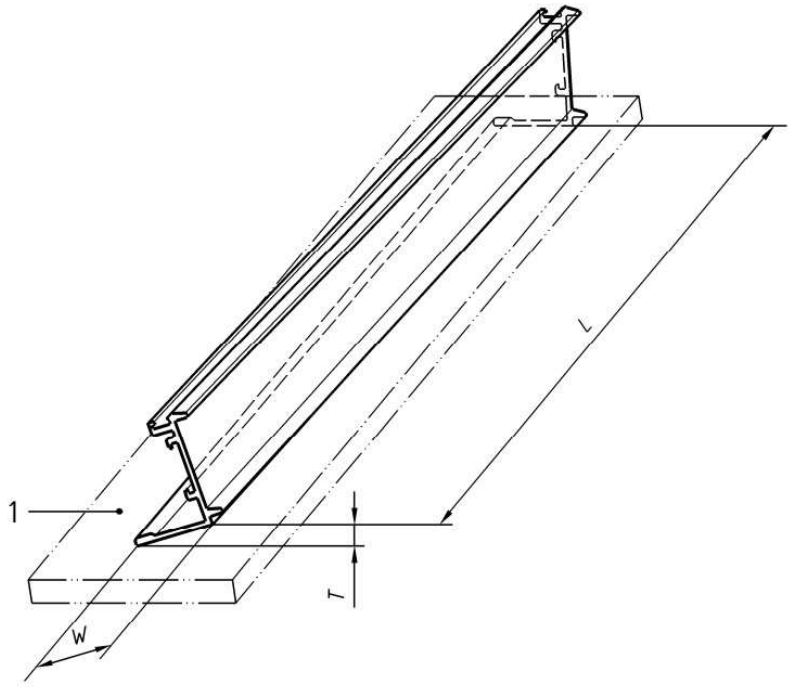
Width W of the contour		Contour tolerance = diameter C of the tolerance circle
Over	Up to and including	
-	30	0,30
30	60	0,50
60	90	0,70
90	120	1,0
120	150	1,2
150	200	1,5
200	250	2,0
250	300	2,5
300	400	3,0
400	500	3,5
500	800	4,0

NOTE Contour tolerances can be checked by placing a section of the profile on a 1:1 scale projection of the drawing with the contour tolerance indicated on the drawing. Another recommended method is the use of suitable gauges (min./max.).

4.5 Twist

Twist T shall be measured as shown in Figure 9 by placing the profile on a flat baseplate the profile resting under own mass, and measuring the maximum distance at any point along the length between the bottom surface of the profile and the baseplate surface.

Twist tolerances are specified in Table 12 as a function of the width W and the length L of the profile.



Key

1 base plate

Figure 9 — Measurement of twist

Table 12 — Twist tolerances

Dimensions in millimetres

Width W		Twist tolerance T for length L		
Over	Up to and including	Per 1 000 of length [a]	On total profile length L	
			Over 1 000 and including 6 000	Over 6 000
-	30	1,2	2,5	3,0
30	50	1,5	3,0	4,0
50	100	2,0	3,5	5,0
100	200	2,5	5,0	7,0
200	300	2,5	6,0	8,0
300	450	3,0	8,0	1,5 x L (L in metres)
450	600	3,5	9,5	
600	800	4,5	10,0	

[a] Twist tolerances for lengths less than 1 000 mm shall be subject to agreement between supplier and purchaser.

4.6 Angularity

The deviation from a specified angle shall be measured as shown in Figures 10 and 11.

The angularity tolerances for right angles shall be as specified in Table 13 as a function of profile width W.

The maximum allowable deviation α in an angle other than a right angle shall be ± 1°.

In the case of unequal side lengths the tolerance on angularity shall apply to the shorter side of the angle, i.e. it is measured starting from the longer side.

Table 13 — Angularity tolerances for right angles

Dimensions in millimetres

Width W		Maximum allowable deviation, Z from a right angle
Over	Up to and including	
-	30	0,4
30	50	0,7
50	80	1,0
80	120	1,4
120	180	2,0
180	240	2,6
240	300	3,1
300	400	3,5

For profiles with W which exceeds 400 mm the tolerances shall be subject to agreement between the supplier and purchaser.

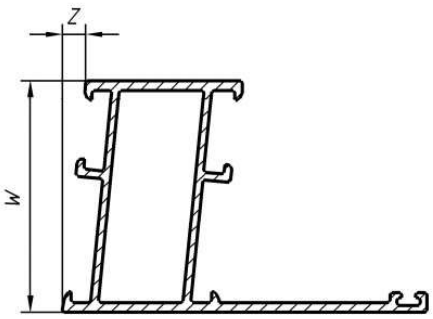


Figure 10 — Measurement of angularity in a right angle

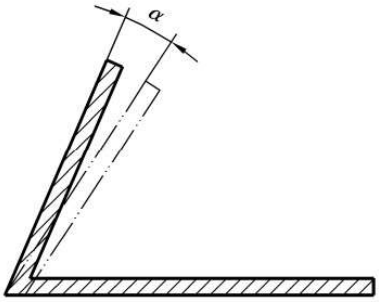


Figure 11 — Measurement of angularity in an angle other than a right angle

4.7 Corner and fillet radii

Sharp corners and fillets may be slightly rounded unless otherwise indicated on the drawing. The maximum allowable corner and fillet radii shall be as specified in Table 14.

When a corner or fillet radius is specified, the maximum allowable deviation from this radius shall be as specified in Table 15.

Table 14 — Maximum allowable corner and fillet radii

Dimensions in millimetres

Wall thickness *A*, *B* or *C* [a]	Maximum allowable radius	
	Alloy group I	Alloy group II [b]
≤ 5	0,6	0,8
> 5	1,0	1,5

[a] Where varying wall thicknesses are involved, the maximum allowable radius in the transition zone is a function of the greater wall thickness.

[b] These tolerances only apply to 6xxx series alloys in group II. The maximum allowable radii for the other alloys in group II shall be subject to agreement between supplier and purchaser.

Table 15 — Maximum allowable deviation from specified corner and fillet radii

Specified radius mm	Maximum allowable deviation from specified radius
≤ 5	± 0,5 mm
> 5	± 10 %

Bibliography

[1] EN 515, *Aluminium and aluminium alloys — Wrought products — Temper designations*