

English Version

Aluminium and aluminium alloys - Extruded precision
profiles in alloys EN AW-6060 and EN AW-6063 - Part 2:
Tolerances on dimensions and form

Aluminium et alliages d'aluminium - Profilés de
précision filés en alliages EN AW-6060 et EN AW-6063
- Partie 2 : Tolérances sur dimensions et forme

Aluminium und Aluminiumlegierungen -
Stranggepresste Präzisionsprofile aus Legierungen EN
AW-6060 und EN AW-6063 - Teil 2: Grenzabmaße und
Formtoleranzen

This European Standard was approved by CEN on 4 March 2016.

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This document consolidates EN 12020-2:2016 and the corrigendum EN 12020-2:2016/AC:2017.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (EN 12020-2:2016) 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of an identical text or by endorsement, at the latest by June 2017, and conflicting national standards shall be withdrawn at the latest by June 2017.

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

This document supersedes EN 12020-2:2008.

The following technical modifications have been introduced during the revision:

- subclause 4.1, Parallelism;
- subclause 4.2, Straightness;
- subclause 4.5, Twist.

EN 12020 comprises the following parts under the general title "*Aluminium and aluminium alloys — Extruded precision profiles in alloys EN AW-6060 and EN AW-6063*":

- *Part 1: Technical conditions for inspection and delivery*
- *Part 2: Tolerances on dimensions and form*

This document includes the corrigendum EN 12020-2:2016/AC:2017 which requests the deletion of the paragraph below Figure 6 in 4.2, the deletion of Figure 7a) and 7b) and the renumbering of the subsequent figures throughout the text, as well as the cross references to them.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

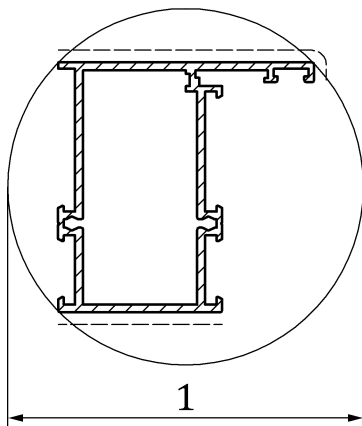
1 Scope

This European Standard specifies tolerances on dimensions and form of extruded precision profiles, in alloys EN AW-6060 and EN AW-6063 manufactured with and without a thermal barrier (see Figures 1 and 2). It applies to extruded products supplied without further surface treatment. Precision profiles covered in this standard are distinguished from extruded profiles for general applications covered in EN 755-9 by the following characteristics:

- they are mainly for architectural applications;
- they meet more stringent requirements regarding the surface condition of visible surfaces;
- the maximum diameter of the circumscribing circle CD is 350 mm;
- they are made to closer tolerances on dimensions and form.

In the case of profiles which, due to the complexity of their design, are difficult to manufacture and specify, then special agreements between supplier and purchaser may need to be reached.

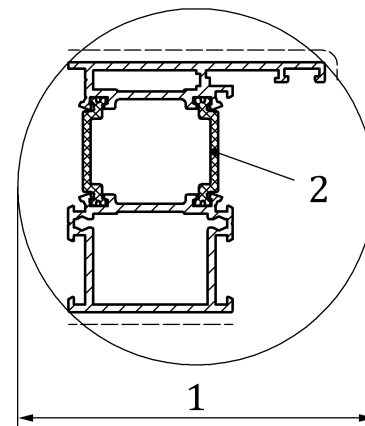
NOTE The effect of the thermal barrier material on the dimensional tolerances is covered by this document although the actual thermal barrier material itself is not (see EN 14024).



Key

1 CD maximum 350 mm

Figure 1 — Profile without thermal barrier



Key

1 CD maximum 350 mm
2 thermal barriers

Figure 2 — Profile containing thermal barrier

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

3 Tolerances on dimensions

3.1 General

If, for compelling reasons, tolerances closer than those specified in 3.2.2 are required, these shall only be specified for dimensions that are critical to the function, subject to specific agreement between supplier and purchaser. Any such reduction shall not exceed two-thirds of the values specified in this standard and is subject to a minimum tolerance band of 0,3 mm.

3.2 Cross-sectional dimensions

3.2.1 General

The tolerances of the following dimensions (see Figure 3) are specified in Tables 1 and 2.

- *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, including open ends.

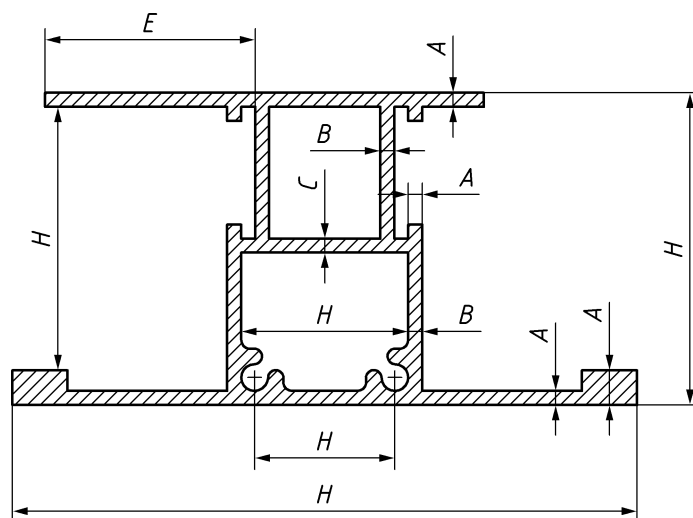


Figure 3 — Definition of dimensions *A*, *B*, *C*, *E*, *H*

3.2.2 Tolerances on dimensions other than wall thickness

The tolerances for dimension *H* shall be as specified in Table 1.

Table 1 — Tolerances on cross-sectional dimensions

Dimensions in millimetres

Dimension <i>H</i>		Tolerances on <i>H</i> (except open ends)	Tolerances on <i>H</i> (open ends)	
Over	Up to and including		<i>E</i> ≤ 60	60 < <i>E</i> ≤ 120 ^a
-	-	±0,15	±0,15	b
10	15	±0,20	±0,20	b
15	30	±0,25	±0,25	b
30	45	±0,30	±0,30	±0,45
45	60	±0,40	±0,40	±0,55
60	90	±0,45	±0,45	±0,65
90	120	±0,60	±0,60	±0,80
120	150	±0,80	±0,80	±1,0
150	180	±1,0	±1,0	±1,3
180	240	±1,2	±1,2	±1,5
240	300	±1,5	±1,5	±1,8
300	350	±1,8	±1,8	±2,1

NOTE Tolerances given in Table 1 do not cover dimensions from a given point inside a closed hollow chamber to any other point outside the chamber.

^a Tolerances for values of dimension *E* over 120 mm shall be subject to agreement between supplier and purchaser.

^b Shall be subject to agreement between purchaser and supplier.

3.2.3 Tolerances on wall thickness of solid and hollow profiles

The tolerances on wall thickness (see Figure 3) of solid and hollow profiles shall be as specified in Table 2.

Table 2 — Tolerances on wall thickness of solid and hollow profiles

Dimensions in millimetres

Nominal wall thickness A, B or C		Tolerances on:			
		Wall thickness A		Wall thickness B and C	
Over	Up to and including	Circumscribing circle $CD \leq 100$	Circumscribing circle $100 < CD \leq 350$	Circumscribing circle $CD \leq 100$	Circumscribing circle $100 < CD \leq 350$
-	2	$\pm 0,15$	$\pm 0,20$	$\pm 0,20$	$\pm 0,30$
2	3	$\pm 0,15$	$\pm 0,25$	$\pm 0,25$	$\pm 0,40$
3	6	$\pm 0,20$	$\pm 0,30$	$\pm 0,40$	$\pm 0,60$
6	10	$\pm 0,25$	$\pm 0,35$	$\pm 0,60$	$\pm 0,80$
10	15	$\pm 0,30$	$\pm 0,40$	$\pm 0,80$	$\pm 1,0$
15	20	$\pm 0,35$	$\pm 0,45$	$\pm 1,2$	$\pm 1,5$
20	30	$\pm 0,40$	$\pm 0,50$	a	a
30	40	$\pm 0,45$	$\pm 0,60$	a	a

^a Shall be subject to agreement between supplier and purchaser.

When, for functional reasons, tolerances are specified for both the outside and inside dimensions of hollow sections, then the deviations given in Table 2 shall not apply as a wall thickness tolerance, but as a tolerance on the difference in wall thickness. This difference shall be determined by measuring the maximum and minimum wall thickness in the same plane.

3.3 Length

If fixed lengths are to be supplied, this shall be stated on the order. The fixed length tolerances shall be as specified in Table 3.

Table 3 — Tolerances on fixed length

Dimensions in millimetres

Circumscribing circle CD		Tolerances on fixed length L			
		$L \leq 2\ 000$	$2\ 000 < L \leq 5\ 000$	$5\ 000 < L \leq 10\ 000$	$L > 10\ 000$
Over	Up to and including				
-	100	+5 0	+7 0	+10 0	Subject to agreement between supplier and purchaser
100	200	+7 0	+9 0	+12 0	
200	350	+8 0	+11 0	+14 0	

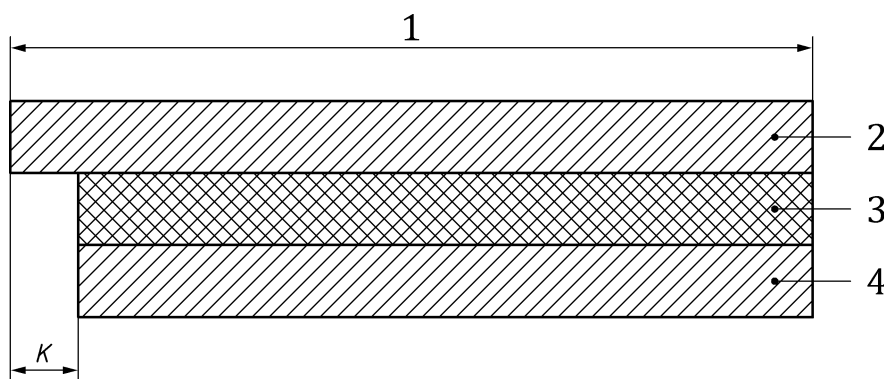
If no fixed or minimum length is specified in the order, profiles may be delivered in random lengths. The length range and the tolerances on the random lengths shall be subject to agreement between supplier and purchaser.

3.4 Squareness of cut ends

The squareness of cut ends shall be within half of the fixed length tolerance range specified in Table 3 for both fixed and random lengths, e.g. for a fixed length tolerance of $^{+10}_0$ mm the deviation from squareness of cut ends shall be within 5 mm measured over the complete cross sectional width of the profile.

3.5 Length offset for profiles with a thermal barrier

Length offset K , see Figure 4 for profiles with a thermal barrier shall be within the tolerance range for the fixed length specified in Table 3, e.g. for a fixed length tolerance of $^{+10}_0$ mm the length offset shall be within 10 mm.



Key

- 1 length of profile
- 2 profile 1
- 3 thermal barrier
- 4 profile 2

Figure 4 — Length offset K

4 Tolerances on form

4.1 Parallelism

Requirements on parallelism // of opposite outer planes shall be subject of agreement between supplier and purchaser and shall be specified on the drawing.

Parallelism shall be marked on the drawing as specified in Figure 5, using the // symbol as in EN ISO 1101.

Tolerances on parallelism shall not increase tolerances on dimensions, i.e. shall always lie within dimensional tolerances or tolerance ranges.

Where outer planes are of unequal length, the longer one shall be taken as contact reference.

Two clearly defined reference points shall specify the width of the parallelism measurement.

The tolerance on parallelism // for outer parallel dimension H apply for cross sectional measurements in a single plane. The value for parallelism may be selected in accordance with the tolerance range given in Table 1 (including those for open ends).

Example Dimension $H = 50 \pm 0,4$, i.e. possible parallelism $//0,8$.

Requirements in Figure 5 ($//, 0,4$) is an example only. Tolerances to be according to Table 1:

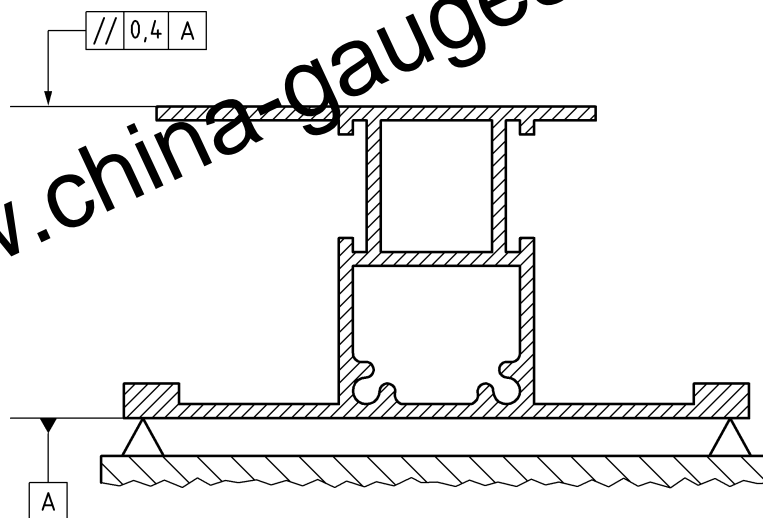


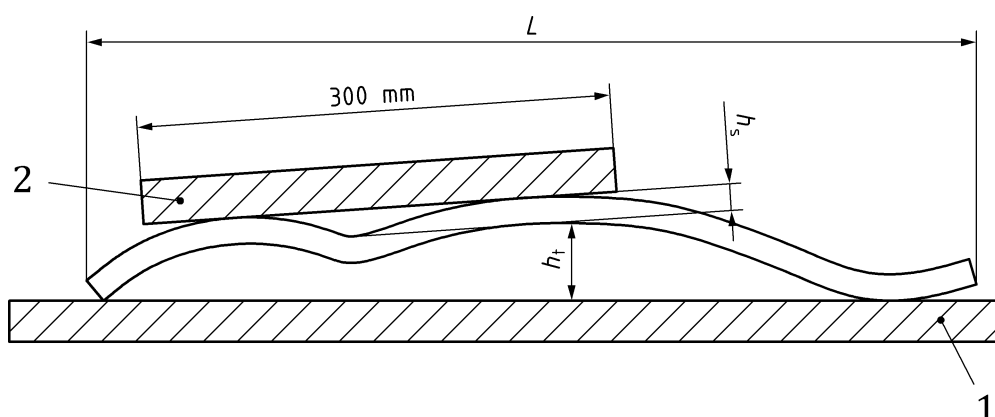
Figure 5 — Marking parallelism for convex and concave surfaces

4.2 Straightness

Deviations from straightness, h_s and h_t , shall be measured as shown in Figure 6, with the profile placed on a horizontal base plate so that its mass decreases the deviation.

The straightness tolerance h_t shall be as specified in Table 4.

The local deviation from straightness h_s shall not exceed 0,3 mm per 300 mm length.



Key

- 1 base plate
- 2 straight edge

Figure 6 — Measurement of deviation from straightness

AC deleted text AC

Should other cases of interpretation and measurement be encountered then the specific requirements and method of measurement shall be subject to agreement between supplier and purchaser.

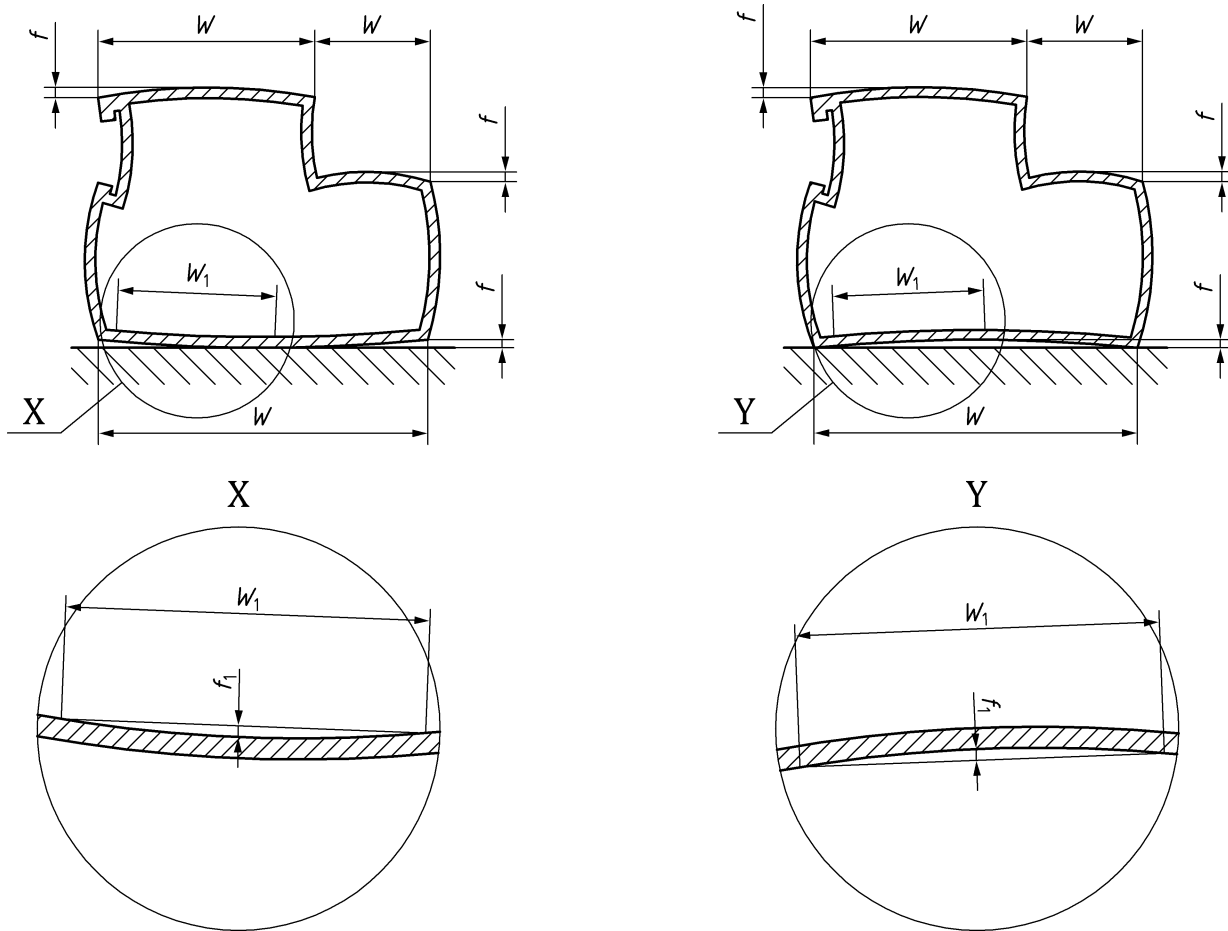
Table 4 — Straightness tolerances

Dimensions in millimetres

Straightness tolerance t_s for specified length L						
$L \leq 1\ 000$	$1\ 000 < L \leq 2\ 000$	$2\ 000 < L \leq 3\ 000$	$3\ 000 < L \leq 4\ 000$	$4\ 000 < L \leq 5\ 000$	$5\ 000 < L \leq 6\ 000$	$L > 6\ 000$
0,7	1,3	1,8	2,2	2,6	3,0	3,5

4.3 Convexity-concavity

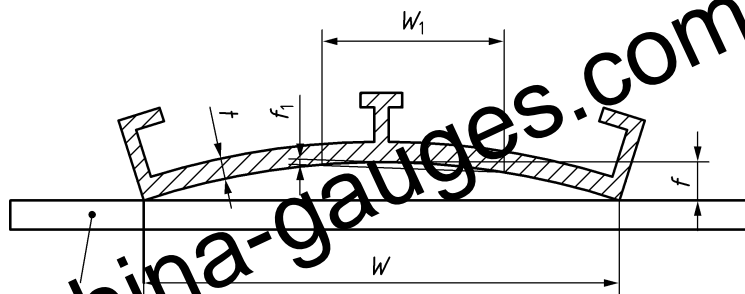
The convexity-concavity f shall be measured as shown in Figures 8 and 9. The tolerances shall be as specified in Table 5.



Key

- W = width
- f = deviation
- W_1 = 100 mm
- f_1 = local deviation per any 100 mm

Figure 7 — Measurement of convexity - concavity for hollow section

**Key**

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

Figure 8 — Measurement of convexity-concavity for open section

Table 5 — Convexity-concavity tolerances

Dimensions in millimetres

Width W		Maximum allowable deviation f
Over	Up to and including	
-	30	0,20
30	60	0,30
60	100	0,40
100	150	0,50
150	200	0,70
200	250	0,85
250	300	1,0
300	350	1,2

In the case of profiles with a width W of over 150 mm, the local deviation f_1 shall not exceed 0,50 mm for any width W_1 of 100 mm.

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 6.

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 9.

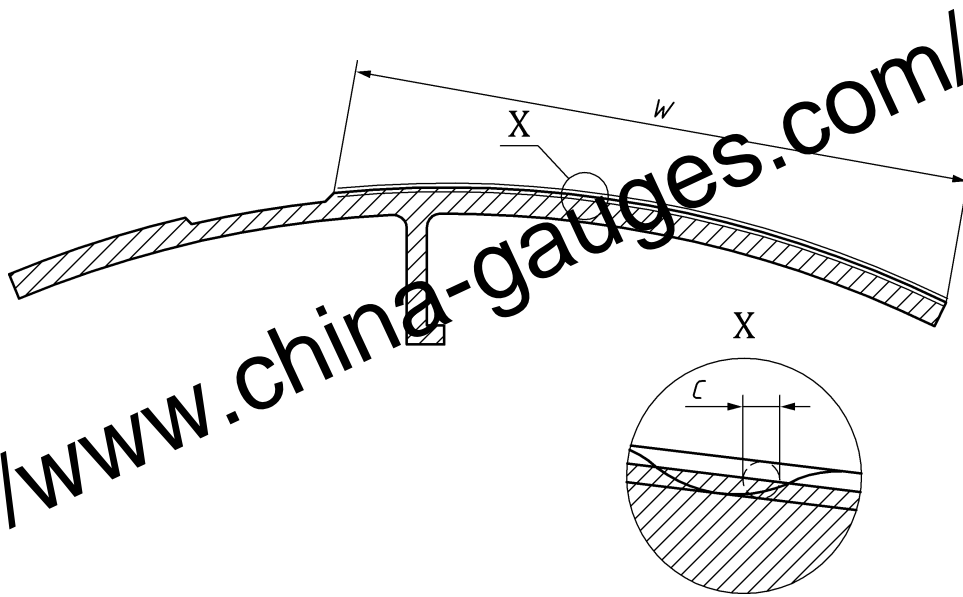


Figure 9 — Definition of contour tolerances

Table 6 — Contour tolerances

Dimensions in millimetres

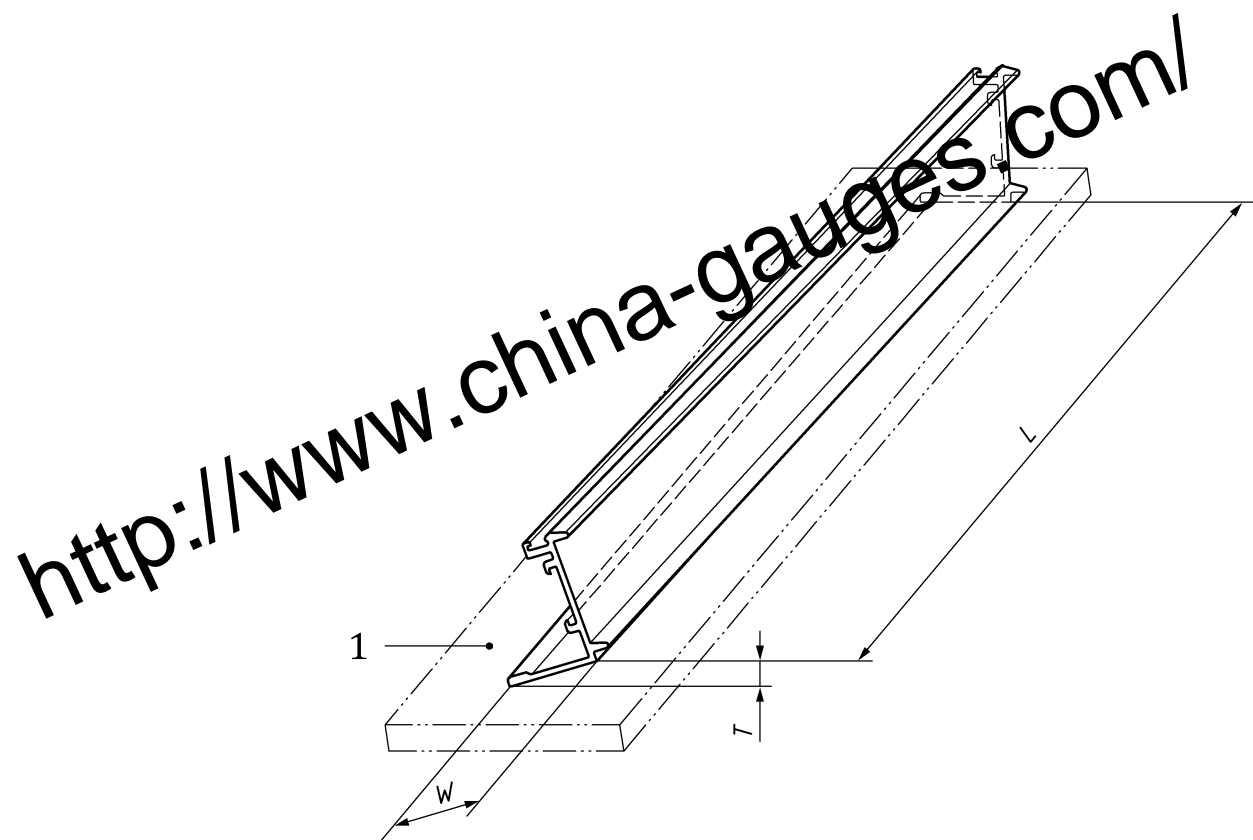
Width W of the contour		Contour tolerance = Diameter C of the tolerance circle
Over	Up to and including	
-	30	0,30
30	60	0,50
60	90	0,70
90	120	1,00
120	150	1,20
150	200	1,50
200	250	2,00
250	300	2,50
300	350	3,00

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

4.5 Twist

Twist T shall be measured as shown in Figure 10 by placing the profile on a flat base plate, the profile resting under its own mass. As shown in Figure 10, twist is determined by measuring the maximum distance between the bottom surface of the profile and the surface of the base plate.

Tolerances shall be specified in Table 7 as a function of the width W and the length L of the profile.

**Key**

1 base plate

AC Figure 10 **AC** — Measurement of twist

AC Figure 10 **AC** shows an example of a simple case of twist. There are other possibilities where the twist has to be identified differently. Some examples are given below:

- Differing positioning of the profile on the base plate such that the maximum twist has to be calculated as the sum of two separate measurements on the diagonal end positions.
- Discontinuous twist over the profile length such that the maximum twist is the difference between specific points along the length. The maximum twist in this case is not necessarily equal to the maximum distance to the base plate and should not be confused with flatness of the surfaces (combination of twist and straightness).

In case of such difficult interpretation of twist, the specific requirements and methods of measurement shall be subject to agreement between supplier and purchaser.

Table 7 — Twist tolerances

Dimensions in millimetres

Width W		Twist tolerances T for specified length L						$L > 6\,000$
Over	Up to and including	$L \leq 1\,000$	$1\,000 < L \leq 2\,000$	$2\,000 < L \leq 3\,000$	$3\,000 < L \leq 4\,000$	$4\,000 < L \leq 5\,000$	$5\,000 < L \leq 6\,000$	
-	75	1,0	1,2	1,5	1,8	2,0	2,0	Subject to agreement between supplier and purchaser
75	100	1,0	1,2	1,5	2,0	2,2	2,5	
100	125	1,0	1,5	1,8	2,2	2,5	3,0	
125	150	1,2	1,5	1,8	2,2	2,5	3,0	
150	200	1,5	1,8	2,2	2,6	3,0	3,5	
200	350	1,8	2,5	3,0	3,5	4,0	4,5	

4.6 Angularity

The deviation from a specified angle shall be measured as shown in Figures 12 and 13.

The angularity tolerances for right angles shall be as specified in Table 8 as a function of profile width W .

The maximum allowable deviation (α) for angles other than a right angle shall be ± 1 (see AC Figure 12 AC).

In the case of unequal side lengths the tolerances on angularity shall apply to the shorter side of the angle, i.e. the measurement should start with the longer side.

Table 8 — Tolerances for right angles

Dimensions in millimetres

Width W		Maximum allowable deviation Z from a right angle
Over	Up to and including	
-	30	0,30
30	50	0,40
50	80	0,50
80	100	0,60
100	120	0,70
120	140	0,80
140	160	0,90
160	180	1,0
180	200	1,2
200	250	1,5

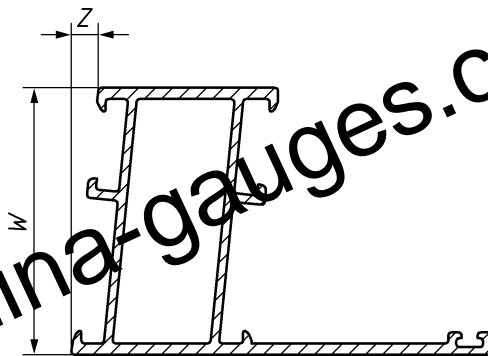


Figure 11 — Measurement of angularity of a right angle

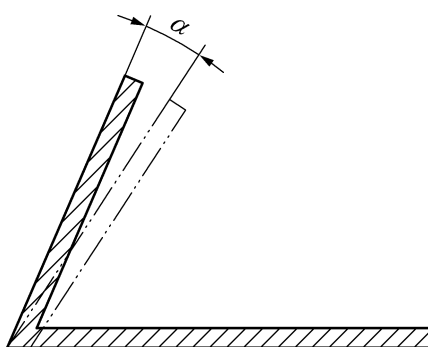


Figure 12 — Measurement of angularity of other than right angles

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 9.

When a corner or fillet radius is specified, the maximum allowable deviation from this specified radius shall be as given in Table 10.

Table 9 — Maximum allowable corner and fillet radii

Dimensions in millimetres

Wall thickness A, B^a or C^a		Maximum allowable corner and fillet radii
Over	Up to and including	
-	3	0,5
3	6	0,6
6	10	0,8
10	20	1,0
20	40	1,5

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

Table 10 — Maximum allowable deviations from specified corner and fillet radii

Specified radius mm	Maximum allowable deviations from specified radius
$\leq 1,0$	$\pm 0,50$ mm
$> 1,0$ to $\leq 5,0$	$\pm 0,50$ mm
$> 5,0$	± 10 %

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Bibliography

- [1] EN 755-9, *Aluminium and aluminium alloys — Extruded rod/bar, tube and profiles — Part 9: Profiles, tolerances on dimensions and form*
- [2] EN 14024, *Metal profiles with thermal barrier — Mechanical performance — Requirements, proof and tests for assessment*

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