

# BS EN 485-4 : 1994

## Aluminium and aluminium alloys - Sheet, strip and plate Part 4. Tolerances on shape and dimensions for cold-rolled products

**Table 1. Thickness tolerances - dimensions in millimetres**

Specified thickness including		Thickness tolerance for specified width													
		Up to and up to and 1000		Over 1000 up to and including 1250		Over 1250 up to and including 1600		Over 1600 up to and including 2000		Over 2000 up to and including 2500		Over 2500 up to and including 3000		Over 3000 including 3500	
Over	Up to and including	Alloy Group		Alloy Group		Alloy Group		Alloy Group		Alloy Group		Alloy Group		Alloy Group	
		I	II	I	II	I	II	I	II	I and II	I and II	I and II	I and II	I and II	I and II
0.2	0.4	±0.02	±0.03	±0.04	±0.05	±0.05	±0.06	-	-	-	-	-	-	-	-
0.4	0.5	±0.03	±0.03	±0.04	±0.05	±0.05	±0.06	±0.06	±0.07	±0.10	-	-	-	-	-
0.5	0.6	±0.03	±0.04	±0.05	±0.06	±0.06	±0.07	±0.07	±0.08	±0.11	-	-	-	-	-
0.6	0.8	±0.03	±0.04	±0.06	±0.07	±0.07	±0.08	±0.08	±0.09	±0.12	-	-	-	-	-
0.8	1.0	±0.04	±0.05	±0.06	±0.08	±0.08	±0.09	±0.09	±0.10	±0.13	-	-	-	-	-
1.0	1.2	±0.04	±0.05	±0.07	±0.09	±0.09	±0.10	±0.10	±0.12	±0.14	-	-	-	-	-
1.2	1.5	±0.05	±0.07	±0.09	±0.11	±0.10	±0.12	±0.11	±0.14	±0.16	-	-	-	-	-
1.5	1.8	±0.06	±0.08	±0.10	±0.12	±0.11	±0.13	±0.12	±0.15	±0.17	-	-	-	-	-
1.8	2.0	±0.06	±0.09	±0.11	±0.13	±0.12	±0.14	±0.14	±0.16	±0.19	-	-	-	-	-
2.0	2.5	±0.07	±0.10	±0.12	±0.14	±0.13	±0.15	±0.15	±0.17	±0.20	-	-	-	-	-
2.5	3.0	±0.08	±0.11	±0.13	±0.15	±0.15	±0.17	±0.17	±0.19	±0.23	-	-	-	-	-
3.0	3.5	±0.10	±0.12	±0.15	±0.17	±0.17	±0.19	±0.18	±0.20	±0.24	-	-	-	-	-
3.5	4.0	±0.15		±0.20		±0.22		±0.23		±0.25	±0.34			±0.38	
4.0	5.0	±0.18		±0.22		±0.24		±0.25		±0.29	±0.36			±0.42	
5.0	6.0	±0.20		±0.24		±0.25		±0.26		±0.32	±0.40			±0.46	
6.0	8.0	±0.24		±0.30		±0.31		±0.32		±0.38	±0.44			±0.50	
8.0	10	±0.27		±0.33		±0.36		±0.38		±0.44	±0.50			±0.56	
10	12	±0.32		±0.38		±0.40		±0.41		±0.47	±0.53			±0.59	
12	15	±0.36		±0.42		±0.43		±0.45		±0.51	±0.57			±0.63	
15	20	±0.38		±0.44		±0.46		±0.48		±0.54	±0.60			±0.66	
20	25	±0.40		±0.46		±0.48		±0.50		±0.56	±0.62			±0.68	
25	30	±0.45		±0.50		±0.53		±0.55		±0.60	±0.65			±0.70	
30	40	±0.50		±0.55		±0.58		±0.60		±0.65	±0.70			±0.75	
40	50	±0.55		±0.60		±0.63		±0.65		±0.70	±0.75			±0.80	

When measuring the thickness, a zone 10 mm wide from the edges of the product shall be disregarded.

### Dimensional tolerances

#### Thickness

For the purpose of this European Standard the alloys are distributed into two groups which correspond to varying difficulty when manufacturing the products. Tighter thickness tolerances apply to Group I alloys (soft alloys).

The grouping is carried out according to the specified chemical composition limits of the alloys (see EN 573-3) as follows:

- Group I alloys:
  - 1000 series alloys;
  - non heat-treatable 7000 and 8000 series alloys;
  - 4000 series alloys with less than 2% maximum specification silicon content;
  - 3000 and 5000 series alloys for which the maximum specified magnesium and manganese contents are each no greater than 1.8% and their sum no greater than 2.3%.
- Group II alloys:
  - all alloys which do not belong to Group I

The split into Group I and Group II of the most commonly used general engineering alloys is given in table 1a.

Thickness tolerances for sheet, strip and plate are specified in table 1.

Other thickness tolerances may be agreed between supplier and purchaser (if agreed between supplier and purchaser, Group I alloys to be supplied to Group II thicknesses).

Table 1a. Alloy split into Group I and Group II					
Group I			Group II		
1080A	1070A	1050A	2014	2017A	2024
1200	3003	3103	3004	5040	5049
3005	3105	4006	5251	5052	5154A
4007	5005	5050	5454	5754	5182
8011A			5083	5086	6061
			6082	7020	7021
			7022	7022	

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**Width**

Width tolerances for strip are specified in table 2.  
 Width tolerances for sheet and plate are specified in table 3.

**Length**

Length tolerances for strip are not specified.  
 Length tolerances for sheet and plate are specified in table 4.

**Table 2. Width tolerances for strip - dimensions in millimetres**

Specified thickness		Width and length tolerance for specified width					
Over	Up to and including	Up to and including 100	Over 100 up to and including 300	Over 300 up to and including 500	Over 500 up to and including 1250	Over 1250 up to and including 1650	Over 1650 up to and including 2600
0.20	0.6	+0.3 0	+0.4 0	+0.6 0	+1.5 0	+2.5 0	+3 0
0.6	1.0	+0.3 0	+0.5 0	+1 0	+1.5 0	+2.5 0	+3 0
1.0	2.0	+0.4 0	+0.7 0	+1.2 0	+2 0	+2.5 0	+3 0
2.0	3.0	+1 0	+1 0	+1.5 0	+2 0	+2.5 0	+4 0
3.0	5.0	-	+1.5 0	+2 0	+3 0	+3 0	5 0

**Table 3. Width tolerances for sheet and plate - dimensions in millimetres**

Specified thickness		Width and length tolerance for specified width				
Over	Up to and including	Up to and including 500	Over 500 up to and including 1250	Over 1250 up to and including 2000	Over 2000 up to and including 3000	Over 3000 up to and including 3500
0.20	3.0	+1.5 0	+3 0	+4 0	+5 0	- 0
3.0	6.0	+3 0	+4 0	+5 0	+8 0	+8 0
6.0	50	+4 0	+5 0	+5 0	+8 0	+8 0

**Table 4. Length tolerances for sheet and plate - dimensions in millimetres**

Specified thickness		Length tolerance for specified length				
Over	Up to and including	Up to and including 1000	Over 1000 up to and including 2000	Over 2000 up to and including 3000	Over 3000 up to and including 5000	Over 5000
0.20	3.0	+3 0	+4 0	+6 0	+8 0	+0.2% of specified length
3.0	6.0	+4 0	+6 0	+8 0	+10 0	
6.0	50	+6 0	+8 0	+10 0	+10 0	

## Shape tolerances

### Lateral curvature

Lateral curvature tolerances for strip with width  $u$  to and including 3500 mm are specified in table 5.

**Table 5. Lateral curvature tolerances for strip - measured on 2000 mm strip length, dimensions in mm**

Specified width		Lateral curvature $d_{max}$
Over	Up to and including	
$\geq 25^{(1)}$	100	8
10	300	6
300	600	5
600	1000	4
1000	2000	3
2000	3500	3

<sup>(1)</sup> For widths less than 25mm the tolerances are to be agreed between purchaser and supplier.

The deviation from straightness,  $d$ , is measured as indicated in figure 1, for a length  $L$  of 2000 mm, from one end of the strip, while the strip is resting on a horizontal base plate.

Lateral curvature tolerances for sheet and plate are specified in table 6.

The deviation from straightness,  $d$ , is measured as indicated in figure 1, while the sheet or plate is resting on a horizontal base plate.

### Flatness

Flatness tolerances for strip are not specified.

Flatness tolerances for sheet and plate are specified in table 7 and are expressed as a percentage of the length  $L$  and/or the width  $W$  and/or the measured chord length  $l$ .

Deviation from flatness,  $d$ , resulting from arching, buckling or edge waves, is measured as shown in figures 2 to 5, using a lightweight straightedge and a feeler gauge, dial gauge or scale, while the sheet or plate is resting on a horizontal base plate concave side upwards.

These tolerances do not apply to sheet and plate supplied in the O (annealed) or F (as fabricated) tempers or to bright sheet.

These tolerances do not include end or corner turnout.

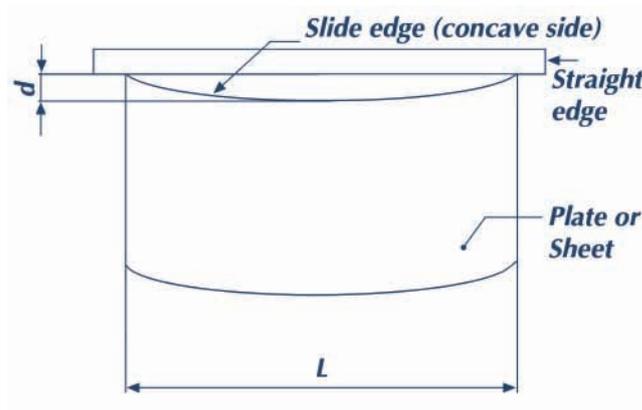
### Squareness

Squareness tolerances for strip are not specified.

Squareness tolerances for sheet and plate are specified in table 8.

The squareness tolerance is expressed as the maximum allowable difference length of diagonals AA and BB as shown in figure 6.

**Fig 1. Lateral curvature of plate or sheet of length  $L$**



$d$  = deviation from straightness

$L$  = length of the sheet or plate



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**Table 6. Lateral curvature tolerances for sheet and plate- dimensions in millimetres**

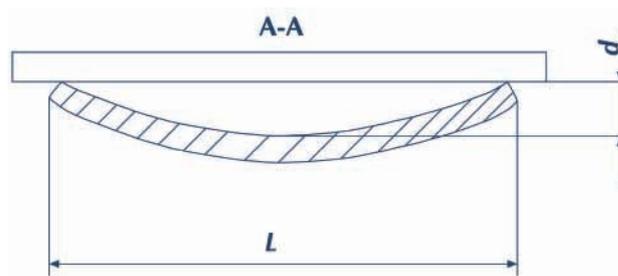
Specified width		Lateral curvature $d_{max}$ for specified length				
Over	Up to and including	Up to and including 1000	Over 1000 up to and including 2000	Over 2000 up to and including 3500	Over 3500 up to and including 5000	Over 5000 up to and including 15000
$\geq 100^{(1)}$	300	2	4	8	—	—
300	600	1.5	3	5	—	—
600	1000	1	2	4	5	+0.1% of specified length
1000	2000	—	2	4	5	
2000	3500	—	—	4	5	

(1) For widths less than 100 mm the tolerances are to be agreed between purchaser and supplier.

**Table 7. Flatness tolerances for sheet and plate**

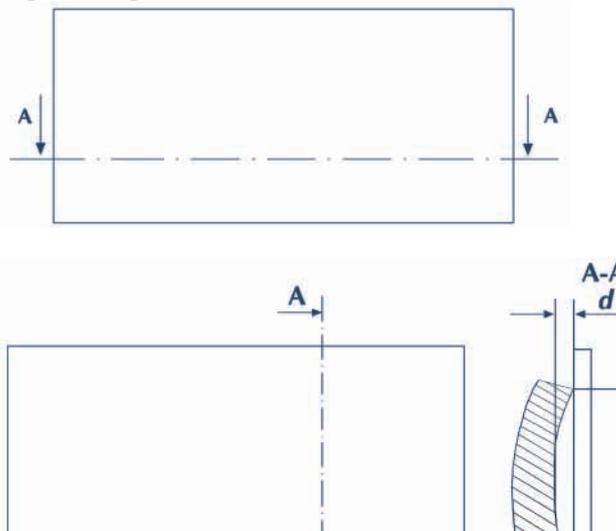
Specified thickness - mm		Total Deviation - %		Partial Deviation
Over	Up to and including	on length $d_{max}/L$	on width $d_{max}/W$	% (for a chord of at least 300mm) $d_{max}/l$
0.20	0.50	by agreement	by agreement	by agreement
0.50	3.0	0.4	0.5	0.5
3.0	6.0	0.3	0.4	0.4
6.0	50	0.2	0.4	0.3

**Fig 2. Transverse arch**



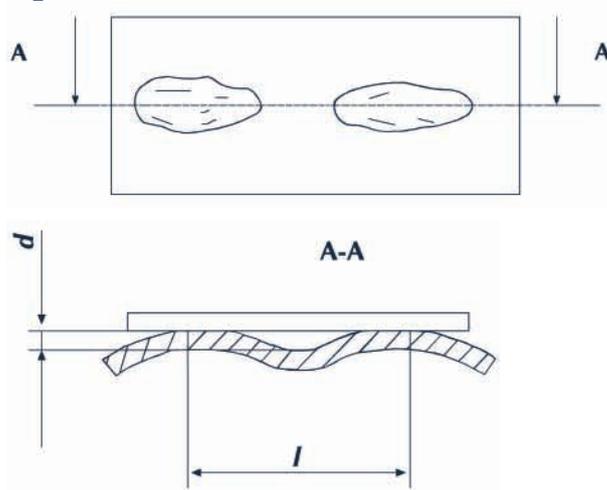
$d$  = deviation from flatness  
 $W$  = width of the sheet or plate

**Fig 3. Longitudinal arch**



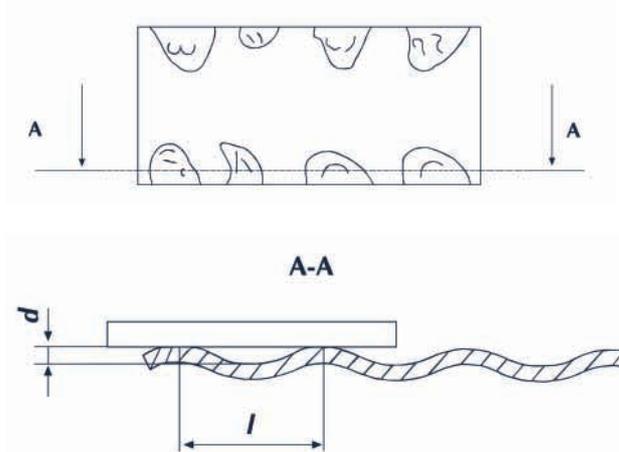
d = deviation from flatness  
L = length of the sheet or plate

**Fig 4. Buckles**



d = deviation from flatness  
L = length of buckle (chord)

**Fig 5. Edge waves**



d = deviation from flatness  
L = length of edge wave (chord)



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**Table 8. Squareness tolerances for sheet and plate- dimensions in millimetres**

Specified length		Specified thickness	Squareness tolerance for specified width			
Over	Up to and including		Up to and including 1000	Over 1000 up to and including 1500	Over 1500 up to and including 2000	Over 2000 up to and including 3500
	1000	≤6	4	–	–	–
		>6	5	–	–	–
1000	2000	≤6	4	5	6	–
		>6	6	7	8	–
2000	3000	≤6	5	5	7	8
		>6	7	7	9	10
3000	5000	≤6	6	8	8	10
		>6	8	10	10	12
5000	15000	≤6	10	10	12	12
		>6	12	12	15	15

**Fig 6. Measurement of squareness**

