
**Hot-rolled steel sheet products —
Dimensional and shape tolerances**

Tôles en acier laminées à chaud — Tolérances sur dimensions et forme



Reference number
ISO 16160:2012(E)

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 16160 was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 12, *Continuous mill flat rolled products*.

This fourth edition cancels and replaces the third edition (ISO 16160:2011), which has been technically revised.

Hot-rolled steel sheet products — Dimensional and shape tolerances

1 Scope

This International Standard applies to dimensional and shape tolerances for all hot-rolled steel sheet products.

NOTE Hot-rolled steel strip and hot-rolled heavy-thickness steel sheet coils are not covered by this International Standard.

2 Dimensional and shape tolerances

Dimensional and shape tolerances are given in Tables 1 to 9.

Table 1 — Thickness tolerances for hot-rolled sheet steel (including descaled sheet), coils and cut lengths

Dimensions and tolerances in millimetres

Specified width	Thickness tolerance ^a for specified thicknesses ^{b, c, d}									
	0,8 ≤ 1,5	> 1,5 ≤ 2,0	> 2,0 ≤ 2,5	> 2,5 ≤ 3,0	> 3,0 ≤ 4,0	> 4,0 ≤ 5,0	> 5,0 ≤ 6,0	> 6,0 ≤ 8,0	> 8,0 ≤ 10,0	> 10,0 ≤ 12,5
600 ≤ 1 200	± 0,13	± 0,14	± 0,15	± 0,16	± 0,18	± 0,20	± 0,22	± 0,25	± 0,27	± 0,30
> 1 200 ≤ 1 500	± 0,14	± 0,15	± 0,16	± 0,18	± 0,20	± 0,22	± 0,24	± 0,26	± 0,28	± 0,31
> 1 500 ≤ 1 800	—	± 0,15	± 0,18	± 0,20	± 0,22	± 0,24	± 0,25	± 0,26	± 0,29	± 0,32
> 1 800	—	—	± 0,21	± 0,22	± 0,23	± 0,25	± 0,26	± 0,30	± 0,34	± 0,38

The values specified do not apply to the uncropped ends for a total length, l , of a mill edge coil. The total length, l , would be calculated using the following formula:

$$\text{Total length, } l, \text{ in metres} = \frac{90}{\text{Thickness in millimetres}}$$

provided that the result was not greater than 20 m, inclusive of both ends.

When International Standards that reference this standard permit slitting sheet to less than 600 mm in width to be considered as sheet, tolerances shall be subject to agreement.

a For specified strength levels of $R_e = 360 \text{ N/mm}^2$ and greater, increase the thickness tolerances by 10 % applying normal rounding-off procedures.

b Thickness is measured at any point on the sheet not less than 25 mm from a sheared edge and 40 mm from a mill edge. Points closer than these are subject to negotiation.

c The specified thickness-range captions apply as a specific value.

d The tolerances provided in this table are based on normal thickness (tolerance over and under). For ordered thicknesses other than nominal, the total tolerance is twice the tabled value and may be distributed as agreed upon between the buyer and seller.

Table 2 — Width tolerances for coils and cut lengths (including descaled material), mill edge

Dimensions and tolerances in millimetres

Specified width	Tolerance
≤ 1 500	+20 0
<p>The values specified do not apply to the uncropped ends for a total length, <i>l</i>, of a mill edge coil. The total length, <i>l</i>, would be calculated using the formula:</p> $\text{Total length, } l, \text{ in metres} = \frac{90}{\text{Thickness in millimetres}}$ <p>provided that the result was not greater than 20 m, inclusive of both ends.</p>	

Table 3 — Width tolerances for coils and cut lengths (including descaled material), sheared edge, not resquared

Dimensions and tolerances in millimetres

Specified width	Tolerance
≤ 1 200	+3 0
> 1 200 ≤ 1 500	+5 0
> 1 500	+6 0
<p>NOTE For resquared material, more restrictive tolerances are subject to negotiation.</p>	

Table 4 — Length tolerances for cut lengths (including descaled material), not resquared

Dimensions and tolerances in millimetres

Specified length	Tolerance
≤ 2 000	+10 0
> 2 000 ≤ 8 000	+0,5%×length 0
> 8 000	+40 0
<p>NOTE For resquared material, more restrictive tolerances are subject to negotiation.</p>	

Table 5 — Camber tolerances for coils and cut lengths (including descaled material), not resquared

Dimensions and tolerances in millimetres

Form	Camber tolerance
Coils	25 in any 5 000 length
Cut lengths	0,5 % length
<p>NOTE For resquared material, more restrictive tolerances are subject to negotiation. The values specified do not apply to the uncropped ends of a mill edge coil for a total length of 7 m. Camber is the greatest deviation of a side edge from a straight line, the measurement being taken on the concave side with a straight edge as shown in Figure 1.</p>	

Table 6 — Out-of-square tolerance for cut lengths (including descaled material), not resquared

Dimensions	Out-of-square tolerance
All thicknesses and all sizes	0,7 % × width

NOTE Out-of-square is the greatest deviation of an edge from a straight line, at right angles to a side and touching one corner, the measurement being taken as shown in Figure 2. It can also be measured as one-half of the difference between the diagonals of the cut-length sheet.

Table 7 — Out-of-square tolerance for resquared material (including descaled material)

Dimensions and tolerances in millimetres

Specified length	Specified width	Out-of-square tolerance ≤ 6 mm thickness
≤ 3 000	≤ 1 200	+1 0
	> 1 200	+2 0
> 3 000	All widths	+2 0

NOTE Out-of-square is the greatest deviation of an edge from a straight line at right angles to a side and touching one corner, the measurement being taken as shown in Figure 2. It can also be measured as one-half of the difference between the diagonals of the cut-length sheet. When measuring material to resquared tolerances, consideration may have to be given to extreme variations in temperature.

Table 8 — Standard flatness tolerances for cut lengths (including descaled material)

Dimensions and tolerances in millimetres

Specified thick- ness	Specified width	Flatness tolerance Specified strength level of R_e		
		< 220 MPa	≥ 220 ≤ 340 MPa	> 340 MPa
≤ 2	≤ 1 200	21	26	32
	> 1 200 ≤ 1 500	25	31	38
	> 1 500	30	38	45
> 2	≤ 1 200	18	22	27
	> 1 200 ≤ 1 500	23	29	34
	> 1 500	28	35	42

NOTE Maximum deviation from a flat horizontal surface: with the sheet lying under its own weight on a flat surface, the maximum distance between the lower surface of the sheet and the flat horizontal surface is the maximum deviation from flatness as shown in Figure 3. This table also applies to sheet cut to length from coil by the customer when agreed-upon flattening procedures are performed.

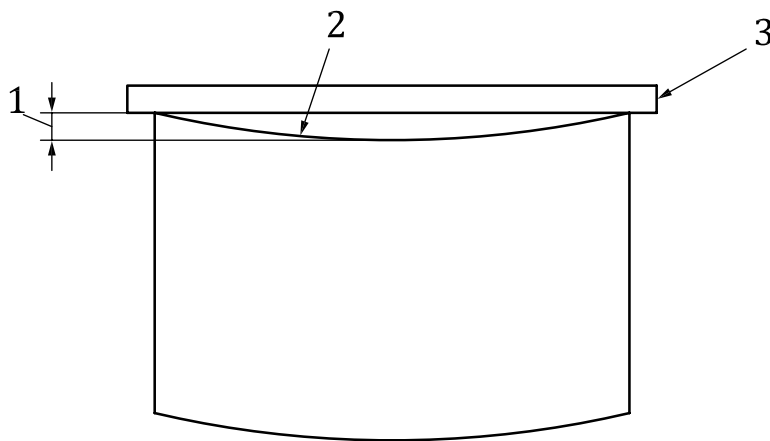
Table 9 — Restricted flatness tolerances for cut lengths (including descaled material)

Dimensions and tolerances in millimetres

Specified thick-ness	Specified width	Flatness tolerance		
		Specified strength level of R_e		
		< 220 MPa	$\geq 220 \leq 340$ MPa	> 340 MPa
≤ 2	$\leq 1\ 200$	18	20	25
	$> 1\ 200 \leq 1\ 500$	20	25	32
	$> 1\ 500$	25	30	40
> 2	$\leq 1\ 200$	16	18	23
	$> 1\ 200 \leq 1\ 500$	20	23	30
	$> 1\ 500$	25	28	38

NOTE Maximum deviation from a flat horizontal surface: with the sheet lying under its own weight on a flat surface, the maximum distance between the lower surface of the sheet and the flat horizontal surface is the maximum deviation from flatness as shown in Figure 3. This table also applies to sheet cut to length from coil by the customer when agreed-upon flattening procedures are performed.

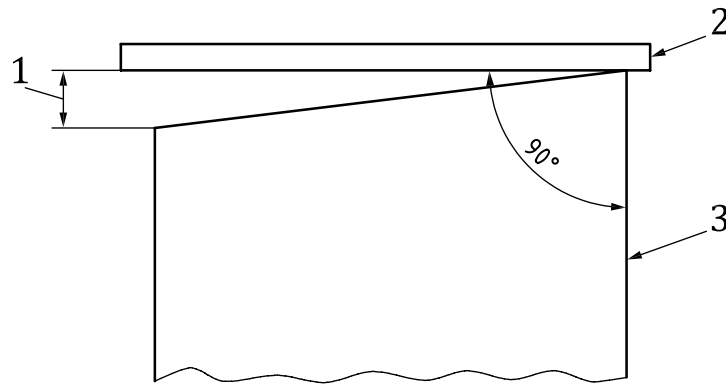
More restrictive tolerances may be negotiated.



Key

- 1 edge camber
- 2 side edge (concave side)
- 3 straight edge

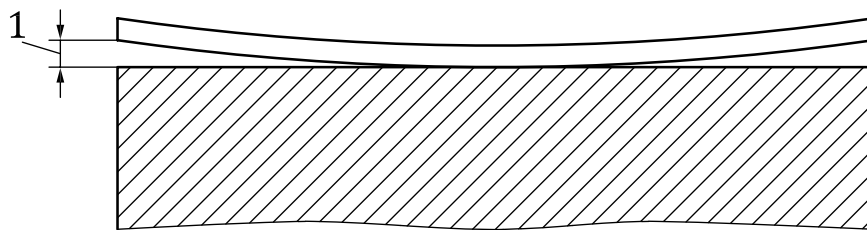
Figure 1 — Measurement of camber



Key

- 1 out-of-square
- 2 straight edge
- 3 side edge

Figure 2 — Measurement of out-of-square



Key

- 1 maximum deviation from flatness

Figure 3 — Measurement of flatness

