INTERNATIONAL STANDARD

ISO 16160

First edition
2000-11-01

Continuously hot-rolled steel sheet products — Dimensional and shape tolerances

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

Reference number
ISO 16160:2000(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.ch
Web www.iso.ch

Printed in Switzerland

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

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

Continuously hot-rolled steel sheet products — Dimensional and shape tolerances

1 Scope

This International Standard applies to dimensional and shape tolerances for all continuously hot-rolled steel sheet products. If a conflict exists with another continuously hot-rolled steel sheet standard that standard shall prevail.

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

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

Dimensions and tolerances in millimetres

Specified width	Thickness tolerances [a] for specified thicknesses [b]									
	> 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	± 0,15	± 0,17	± 0,18	± 0,20	± 0,22	± 0,24	± 0,26	± 0,29	± 0,32	± 0,35
> 1 200 ⩽ 1 500	± 0,17	± 0,19	± 0,21	± 0,22	± 0,24	± 0,26	± 0,28	± 0,30	± 0,33	± 0,36
> 1 500 ⩽ 1 800	—	± 0,21	± 0,23	± 0,24	± 0,26	± 0,28	± 0,29	± 0,31	± 0,34	± 0,37
> 1 800	—	—	± 0,25	± 0,26	± 0,27	± 0,29	± 0,31	± 0,35	± 0,40	± 0,43

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.

[a] For specified strength levels of R_e = 360 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.

Table 2 — Restricted thickness tolerances for hot-rolled sheet steel (including descaled sheet), coils and cut lengths

Dimensions and tolerances in millimetres

Specified width	Thickness tolerances [a] for specified thicknesses [b]									
	> 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	± 0,10	± 0,13	± 0,14	± 0,15	± 0,17	± 0,19	± 0,21	± 0,23	± 0,26	± 0,28
> 1 200 ⩽ 1 500	± 0,12	± 0,14	± 0,15	± 0,17	± 0,18	± 0,21	± 0,22	± 0,24	± 0,26	± 0,29
> 1 500 ⩽ 1 800	—	± 0,14	± 0,17	± 0,19	± 0,21	± 0,22	± 0,23	± 0,25	± 0,27	± 0,30
> 1 800	—	—	± 0,20	± 0,21	± 0,22	± 0,23	± 0,25	± 0,28	± 0,32	± 0,36

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.

[a] For specified strength levels of R_e = 360 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.

Table 3 — Width tolerances for coils and cut lengths (including descaled material), mill edge

Dimensions and tolerances in millimetres

Specified width	Tolerance
⩽ 1 500	$^{+20}_{0}$
> 1 500	$^{+25}_{0}$

The values specified do not apply to the uncropped ends for a total length "l" of a mill edge coil.

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.

Table 4 — 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	$^{+6}_{0}$

NOTE For resquared material more restrictive tolerances are subject to negotiation.

Table 5 — Length tolerances for cut lengths (including descaled material), not resquared

Dimensions and tolerances in millimetres

Specified width	Tolerance
$\leqslant$ 2 000	$^{+10}_{0}$
> 2 000 $\leqslant$ 8 000	$^{+\ 0{,}5\ \% \times \text{length}}_{0}$
> 8 000	$^{+40}_{0}$
NOTE For resquared material more restrictive tolerances are subject to negotiation.	

Table 6 — Camber tolerances for coils and cut lengths (including descaled material), not resquared

Form	Camber tolerance
Coil	25 mm in any 5 000 length
Cut lengths	0,5 % $\times$ length
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.	

Table 7 — Out-of-square tolerance for cut lengths (including descaled material), not resquared

Dimensions	Out-of-square tolerance
All thicknesses and all sizes	1 % $\times$ 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 the difference between the diagonals of the cut length sheet. For resquared material more restrictive tolerances are subject to negotiation.	

Table 8 — Out-of-square tolerances for resquared material (including descaled material)

Dimensions and tolerances in millimetres

Specified length	Specified width	Out-of-square tolerance ⩽ 6mm thickness
⩽ 3 000	⩽ 1 200	$^{+2}_{0}$
	> 1 200	$^{+3}_{0}$
> 3 000	All widths	$^{+3}_{0}$

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 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.

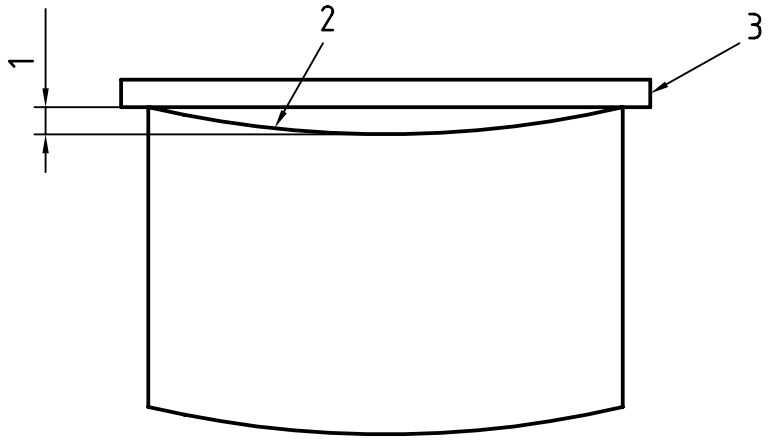
Table 9 — Standard flatness tolerances for cut lengths (including descaled material)

Dimensions and tolerances in millimetres

Specified thickness	Specified width	Flatness tolerance [a]		
		Specified strength level of R_e		
		< 220 N/mm^2	220 to 320 N/mm^2	Over 320 N/mm^2
⩽ 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.

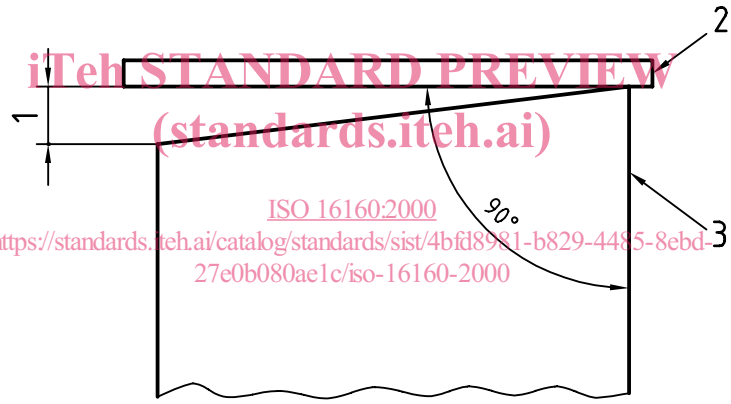
[a] These tolerances are only applicable to sheet up to and including 5 000 mm length. Tolerances for sheet having a length exceeding 5 000 mm shall be subject to agreement. This table also applies to sheet cut to length from coil by the customer when agreed-upon flattening procedures are performed.



Key

1 Edge camber
2 Side edge (concave side)
3 Straightedge

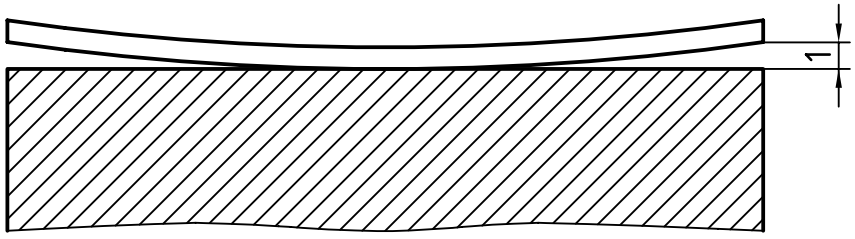
Figure 1 — Measurement of camber



Key

1 Out-of-square
2 Straightedge
3 Side edge

Figure 2 — Measurement of out-of-square



Key

1 Maximum deviation from flatness

Figure 3 — Measurement of flatness