INTERNATIONAL STANDARD

ISO 9445-2

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Continuously cold-rolled stainless steel — Tolerances on dimensions and form —

Part 2: Wide strip and plate/sheet

Acier inoxydable laminé à froid en continu — Tolérances sur les dimensions et la forme —

Partie 2: Larges bandes et tôles

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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 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 9445-2 was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 4, *Heat treatable and alloy steels*.

This first edition of ISO 9445-2, together with ISO 9445-1, cancels and replaces ISO 9445:2002, the contents of which have been technically revised and separated into two parts.

ISO 9445 consists of the following parts, under the general title *Continuously cold-rolled stainless steel — Tolerances on dimensions and form*:

— *Part 1: Narrow strip and cut lengths*

— *Part 2: Wide strip and plate/sheet*

Continuously cold-rolled stainless steel — Tolerances on dimensions and form —

Part 2:
Wide strip and plate/sheet

1 Scope

This part of ISO 9445 specifies the tolerances on dimensions and form for continuously cold-rolled stainless steel wide strip and plate/sheet, in thicknesses from 0,30 mm to 8,0 mm and in rolling widths from 600 mm to 2 100 mm. It also applies to slit cold-rolled wide strip in widths less than 600 mm manufactured from wide strip by longitudinal slitting and to cut lengths manufactured from such strip.

2 Normative references

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

ISO 6929, *Steel products — Definitions and classification*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6929 apply.

4 Information to be supplied by the purchaser

4.1 It shall be the responsibility of the purchaser to specify all requirements that are necessary for products under this specification. Such requirements to be considered include, in the order listed, but are not limited to, the following:

a) the type of delivery [see 5.2 a) to 5.2 d)];

b) the number of this International Standard, i.e. ISO 9445-2;

c) the thickness in millimetres (if necessary accurate to two decimal places) and, if required, including the relevant code letter (S) for a special tolerance;

d) the measurement of the thickness method to be used, either method A in accordance with 17.2 and tolerances according to Table 1 with the relevant code letter (A) or method B in accordance with 17.3 and tolerances according to Table 2 with the relevant code letter (B);

e) the width in millimetres and, if required, including the relevant code letter (S) for a special tolerance;

f) for cold-rolled wide strip and plate/sheet, whether mill (M) or trimmed (T) edges are required. The other products will normally have trimmed edges (see 5.3);

g) for plate/sheet and cut lengths, the length in millimetres and, if a special tolerance is required, the code letter S;

h) for cold-rolled plate/sheet and cut lengths, the code letter FS where a special tolerance is required for flatness.

EXAMPLE 1 Cut length obtained from slit cold-rolled wide strip according to this part of ISO 9445 with a specified thickness of 1,5 mm, special thickness tolerance (S), measuring method A, with a specified width of 200 mm, special tolerance on width (S), with a specified length of 500 mm, special tolerance on length (S) and a special tolerance on flatness (FS).

Cut length from slit cold-rolled wide strip ISO 9445-2 – 1,5SA x 200S x 500S-FS

EXAMPLE 2 Cold-rolled wide strip according to this part of ISO 9445 with a specified thickness of 0,8 mm, normal tolerance, measuring method B, width 1 250 mm, with trimmed edges (T).

Cold-rolled wide strip ISO 9445-2 – 0,80B x 1250T

4.2 In the absence of information in the order concerning special requirements for tolerances on dimension and shape [see 4.1 c), e), g) and h)], flat products covered by this part of ISO 9445 will be delivered according to the basic specifications of this part of ISO 9445, i.e. with normal tolerances.

5 Type of delivery and delivery condition

5.1 General

In the absence of agreements at the time of enquiry and order concerning special requirements for the delivery conditions given in 5.3, flat products covered by this part of ISO 9445 will be delivered according to the basic specifications of this part of ISO 9445.

5.2 Type of delivery

Flat products according to this part of ISO 9445 can be supplied as

a) cold-rolled wide strip (strip in rolled widths equal to or greater than 600 mm);

b) cold-rolled plate/sheet [cut from cold-rolled wide strip according to item 5.2 a)];

c) slit cold-rolled wide strip [manufactured by longitudinal slitting of wide strip according to item 5.2 a)];

d) cut lengths from slit cold-rolled wide strip [cut from slit cold-rolled wide strip according to item 5.2 c)].

5.3 Delivery condition of cold-rolled wide strip and products obtained from cold-rolled wide strip

Cold-rolled wide strip and plate/sheet cut from cold-rolled wide strip are supplied with either mill (M) or trimmed (T) edges. Slit cold-rolled wide strip and cut lengths obtained from slit cold-rolled wide strip normally have trimmed edges.

6 Preferred thicknesses

For cold-rolled wide strip and the products obtained from cold-rolled wide strip [see 5.2 a), 5.2 b), 5.2 c) and 5.2 d)], the following preferred thicknesses exist:

0,30 mm; 0,40 mm; 0,50 mm; 0,60 mm; 0,70 mm; 0,80 mm; 1,00 mm; 1,20 mm; 1,50 mm; 2,00 mm; 2,50 mm; 3,00 mm; 4,00 mm; 5,00 mm; 6,00 mm; 8,00 mm.

7 Tolerances on thickness for cold-rolled wide strip and products obtained from cold-rolled wide strip

The tolerances on thickness can be taken from Table 1 (see 17.2 – method A) or Table 2 (see 17.3 – method B).

NOTE The two tables are necessary to recognize different “custom and practice” in different countries with respect to measurement methods.

Table 1 — Tolerances on specified thickness for cold-rolled wide strip, plate/sheet cut from cold-rolled wide strip, slit cold-rolled wide strip and cut lengths obtained from slit cold-rolled wide strip

Dimensions in millimetres

Specified thickness t	Normal tolerances for a rolled width of	Special tolerances (S) for a rolled width of		
	$w \leqslant 2\,100$	$w \leqslant 1\,000$	$1\,000 < w \leqslant 1\,300$	$1\,300 < w \leqslant 2\,100$
$0{,}30 \leqslant t < 0{,}50$	± 0,04	± 0,025	± 0,030	—
$0{,}50 \leqslant t < 0{,}60$	± 0,05	± 0,030	± 0,035	—
$0{,}60 \leqslant t < 0{,}80$	± 0,05	± 0,035	± 0,040	—
$0{,}80 \leqslant t < 1{,}00$	± 0,06	± 0,040	± 0,045	± 0,050
$1{,}00 \leqslant t < 1{,}20$	± 0,07	± 0,045	± 0,045	± 0,050
$1{,}20 \leqslant t < 1{,}50$	± 0,08	± 0,050	± 0,055	± 0,060
$1{,}50 \leqslant t < 2{,}00$	± 0,09	± 0,055	± 0,060	± 0,070
$2{,}00 \leqslant t < 2{,}50$	± 0,10	—	—	—
$2{,}50 \leqslant t < 3{,}00$	± 0,12	—	—	—
$3{,}00 \leqslant t < 4{,}00$	± 0,14	—	—	—
$4{,}00 \leqslant t < 5{,}00$	± 0,15	—	—	—
$5{,}00 \leqslant t < 6{,}50$	± 0,15	—	—	—
$6{,}50 \leqslant t \leqslant 8{,}00$	± 0,17	—	—	—

NOTE The tolerances are measured in accordance with 17.2 – method A.

Table 2 — Tolerances on specified thickness for cold-rolled wide strip, plate/sheet cut from cold-rolled wide strip, slit cold-rolled wide strip and cut lengths obtained from slit cold-rolled wide strip

Dimensions in millimetres

Specified thickness	Normal tolerances for a specified width of			Special tolerances (S) for a specified width of		
t	$w \leqslant 1\,000$	$1\,000 < w \leqslant 1\,300$	$1\,300 < w \leqslant 2\,100$	$w \leqslant 1\,000$	$1\,000 < w \leqslant 1\,300$	$1\,300 < w \leqslant 2\,100$
$t < 0{,}30$	± 0,030	—	—	± 0,030	—	—
$0{,}30 \leqslant t < 0{,}40$	± 0,04	± 0,04	—	± 0,030	± 0,035	—
$0{,}40 \leqslant t < 0{,}50$	± 0,04	± 0,04	—	± 0,035	± 0,035	—
$0{,}50 \leqslant t < 0{,}60$	± 0,045	± 0,05	—	± 0,035	± 0,035	—
$0{,}60 \leqslant t < 0{,}80$	± 0,05	± 0,05	—	± 0,040	± 0,040	—
$0{,}80 \leqslant t < 1{,}00$	± 0,055	± 0,06	± 0,07	± 0,040	± 0,050	± 0,050
$1{,}00 \leqslant t < 1{,}20$	± 0,06	± 0,07	± 0,08	± 0,050	± 0,055	± 0,060
$1{,}20 \leqslant t < 1{,}50$	± 0,08	± 0,08	± 0,10	± 0,055	± 0,060	± 0,060
$1{,}50 \leqslant t < 2{,}00$	± 0,08	± 0,09	± 0,11	± 0,065	± 0,070	± 0,080
$2{,}00 \leqslant t < 2{,}50$	± 0,09	± 0,11	± 0,13	—	—	—
$2{,}50 \leqslant t < 3{,}00$	± 0,11	± 0,13	± 0,15	—	—	—
$3{,}00 \leqslant t < 4{,}00$	± 0,14	± 0,15	± 0,16	—	—	—
$4{,}00 \leqslant t < 5{,}00$	± 0,15	± 0,17	± 0,19	—	—	—
$5{,}00 \leqslant t < 6{,}00$	± 0,17	± 0,20	± 0,23	—	—	—
$6{,}00 \leqslant t \leqslant 8{,}00$	± 0,17	± 0,22	± 0,25	—	—	—

NOTE The tolerances are measured in accordance with 17.3 – method B.

8 Tolerances on width for cold-rolled wide strip and products obtained from cold-rolled wide strip

The tolerances on width are given in Table 3 (mill edges) and Table 4 (trimmed edges).

Table 3 — Tolerances on width for cold-rolled wide strip and sheet/plate cut from cold-rolled wide strip with mill edges

Dimensions in millimetres

Tolerances for a specified width of	
$600 \leqslant w < 1\,000$	$1\,000 \leqslant w \leqslant 2\,100$
$^{+25}_{0}$	$^{+30}_{0}$

Table 4 — Tolerances on width for cold-rolled wide strip, plate/sheet cut from cold-rolled wide strip, slit cold-rolled wide strip and cut lengths obtained from slit cold-rolled wide strip with trimmed edges

Dimensions in millimetres

Specified thickness	Normal tolerances [a] for a specified width of					Special tolerances (S) [a] for a specified width of		
t	$w \leqslant 125$ [b]	$125 < w \leqslant 250$ [b]	$250 < w < 600$ [b]	$600 \leqslant w \leqslant 1\,000$ [b]	$1\,000 < w \leqslant 2\,100$ [b]	$w \leqslant 125$	$125 < w \leqslant 250$	$250 < w < 600$
$t < 1{,}00$	+ 0,5 0	+ 0,5 0	+ 0,7 0	+ 1,5 0	+ 2,0 0	+ 0,3 0	+ 0,3 0	+ 0,6 0
$1{,}00 \leqslant t < 1{,}50$	+ 0,7 0	+ 0,7 0	+ 1,0 0	+ 1,5 0	+ 2,0 0	+ 0,4 0	+ 0,5 0	+ 0,7 0
$1{,}50 \leqslant t < 2{,}50$	+ 1,0 0	+ 1,0 0	+ 1,2 0	+ 2,0 0	+ 2,5 0	+ 0,6 0	+ 0,7 0	+ 0,9 0
$2{,}50 \leqslant t < 3{,}50$	+ 1,2 0	+ 1,2 0	+ 1,5 0	+ 3,0 0	+ 3,0 0	+ 0,8 0	+ 0,9 0	+ 1,0 0
$3{,}50 \leqslant t \leqslant 8{,}00$	+ 2,0 0	+ 2.0 0	+ 2,0 0	+ 4,0 0	+ 4,0 0	—	—	—

[a] By special agreement, products can be supplied with permissible undersizes on the specified width. In this case, the values in this table apply as the oversize plus undersize range.

[b] For material with edges re-cut by shearing, the tolerances on width may by agreement be increased to 5 mm.

9 Preferred coil inner diameters for cold-rolled wide strip and slit cold-rolled wide strip

The inside diameter of the coil should be decided by mutual agreement. Preferred inside diameters of coils are approximately 500 mm and approximately 600 mm; in the case of slit cold-rolled wide strip, approximately 400 mm may also be available.

10 Tolerances on length for plate/sheet cut from cold-rolled wide strip and for cut lengths obtained from slit cold-rolled wide strip

The tolerances on length are given in Table 5.

Table 5 — Length tolerances for plate/sheet cut from cold-rolled wide strip and for cut lengths obtained from slit cold-rolled wide strip

Dimensions in millimetres

Specified length	Tolerances	
l	Normal	Special (S)
$l \leqslant 2\,000$	$^{+5}_{0}$	$^{+3}_{0}$
$2\,000 < l$	$^{+0{,}002\,5\,l}_{0}$	$^{+0{,}001\,5\,l}_{0}$

11 Tolerances on edge camber for cold-rolled wide strip and products obtained from cold-rolled wide strip

The edge camber tolerances are given in Table 6. These tolerances do not apply to material supplied in the work-hardened condition, for which any requirement shall be agreed between manufacturer and purchaser.

This requirement can be verified on plate/sheet and cut lengths only. However, products cut from strip should also fulfil this requirement.

Table 6 — Tolerances on edge camber for cold-rolled wide strip, plate/sheet cut from cold-rolled wide strip, slit cold-rolled wide strip and cut lengths obtained from slit cold-rolled wide strip

Dimensions in millimetres

Specified width w	Edge camber tolerances [a] for measuring length	
	1 000	2 000
$10 \leqslant w < 40$	2,5	10
$40 \leqslant w < 125$	2	8
$125 \leqslant w < 600$	1,5	6
$600 \leqslant w \leqslant 2\,100$	1	4

[a] If applicable, both measuring lengths shall be used.

12 Tolerances on squareness for plate/sheet obtained from cold-rolled wide strip and cut lengths obtained from slit cold-rolled wide strip

The out-of-squareness for plate/sheet obtained from cold-rolled wide strip and cut lengths obtained from slit cold-rolled wide strip shall not exceed 0,5 % of the width of the product, or alternatively shall not exceed the values in Table 7.

Table 7 — Tolerances on squareness for plate/sheet obtained from cold-rolled wide strip and cut lengths obtained from slit cold-rolled wide strip, in terms of the difference between the diagonal lengths of the product

Dimensions in millimetres

Length l	Maximum difference in diagonal lengths
$l \leqslant 3\,000$	6
$3\,000 < l \leqslant 6\,000$	10
$l > 6\,000$	15

13 Tolerances on flatness for plate/sheet obtained from cold-rolled wide strip and cut lengths obtained from slit cold-rolled wide strip

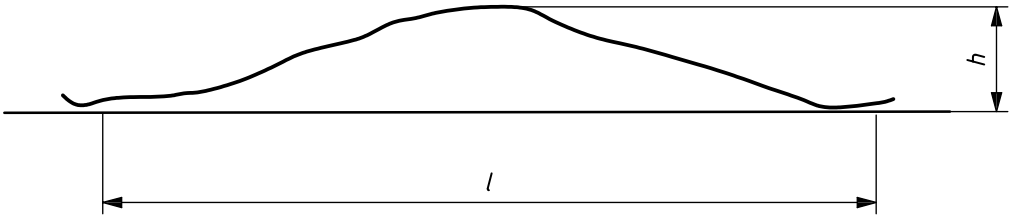
The flatness tolerances for plate/sheet obtained from cold-rolled wide strip and cut lengths obtained from slit cold-rolled wide strip shall not exceed 10 mm for normal cases and 7 mm where a special tolerance (FS) is required for lengths $\leqslant$ 3 000 mm and 12 mm for normal cases and 8 mm where a special tolerance (FS) is required for lengths $>$ 3 000 mm.

This requirement does not apply to material supplied in the work-hardened condition and in the condition 2D (cold-rolled, heat-treated, pickled).

14 Edge waviness tolerances for cold-rolled strip

For cold-rolled wide strip or slit cold-rolled wide strip, the waviness of the edges, i.e. the ratio of wave height (h) to wave length (l) shall be maximum 0,03 for all thicknesses (see Figure 1).

This requirement does not apply to material supplied in the work-hardened condition and in the condition 2D (cold-rolled, heat-treated, pickled).



Key

h/l = waviness

Figure 1 — Edge waviness tolerances for cold-rolled strip

15 Form of coils

The coils delivered according to this part of ISO 9445 shall be tightly wound, as round as possible and with straight edges. Gradual displacement of the edge of the strip to one side shall not exceed 35 mm in case of trimmed (slit) edges and 70 mm in case of mill (as rolled) edges.

16 Ordered format for plate/sheet and cut lengths

When ordering, an agreement may be made that the ordered format be contained in every piece supplied. In this case, the tolerances on width, length, edge camber and out-of-squareness shall be agreed at the time of enquiry and order.

17 Measurement of thickness for cold-rolled wide strip, plate/sheet cut from cold-rolled wide strip, slit cold-rolled wide strip and cut lengths obtained from slit cold-rolled wide strip

17.1 The two methods given below in 17.2 (method A) and 17.3 (method B) are alternatives, for use with Tables 1 and 2 respectively.

17.2 Method A: The thickness is measured at any point located more than 20 mm from the edges in the case of slit edges and at any point located more than 30 mm from the edges in the case of mill edges, if the tolerances according to Table 1 are chosen.

17.3 Method B: The thickness is measured at any point located more than 15 mm from the edges in the case of slit edges and at any point located more than 25 mm from the edges in the case of mill edges, if the tolerances according to Table 2 are chosen.

17.4 In the case of slit cold-rolled wide strip and cut lengths having a width of 30 mm or below, the position of measurement shall be at the middle axis.

18 Measurement of width

The width is measured perpendicularly to the rolling direction of the product.

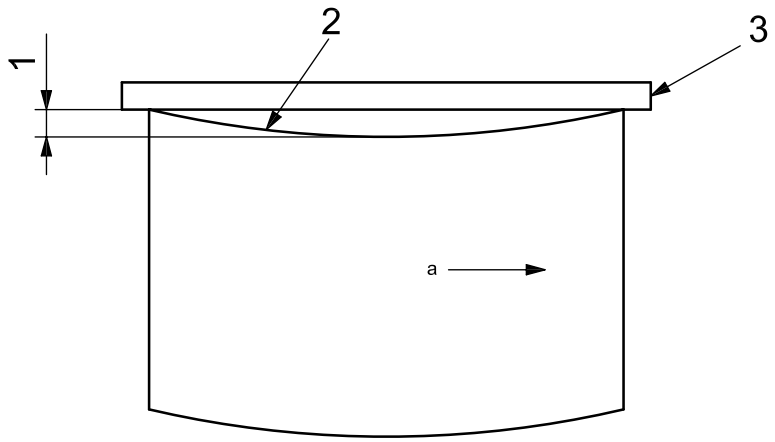
19 Measurement of length

The length of plate/sheet or cut lengths is measured along the rolling direction of the product.

20 Measurement of edge camber

20.1 Edge 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 (see Figure 2).

20.2 Edge camber is not normally measured by the manufacturer, unless compliance is in doubt.



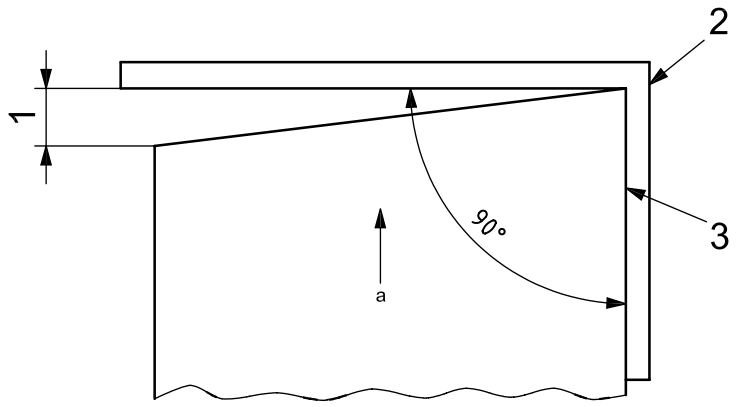
Key

1 edge camber
2 side edge (concave side)
3 straight edge
a Rolling direction.

Figure 2 — Measurement of edge camber

21 Measurement of squareness

21.1 Out-of-squareness is the greatest deviation of an end edge from a straight edge of a square placed at right angles to a side and touching one corner (see Figure 3).



Key

1 out-of-squareness

2 square

3 side edge

a Rolling direction.

Figure 3 — Measurement of out-of-squareness

21.2 For sheet obtained from cold-rolled wide strip and cut lengths obtained from slit cold-rolled wide strip, the out-of-squareness may alternatively be measured by difference between the diagonal length.

21.3 The out-of-squareness is not normally measured by the manufacturer, unless compliance is in doubt.

22 Measurement of flatness and waviness

22.1 Flatness tolerances can be measured in the following ways:

a) Maximum deviation from a flat horizontal surface. With the product lying under its own mass on a flat surface, the maximum deviation from flatness is the maximum distance between the lower surface of the product and the flat horizontal surface.

b) To measure the flatness, the product shall be laid on an approximately flat surface. Deviation with respect to flatness shall be taken as the greatest distance between the product and a straight-edge placed upon it. The straight-edge should be either 1 000 mm or 2 000 mm long. It may be placed on the product at any position and in any direction. Only the position of the points of contact of product and straight-edge shall be taken into account.

Unless otherwise agreed, the choice of measurements is left to the manufacturer.

22.2 The measurement of waviness is only made on edges.

22.3 Flatness and waviness are not normally measured by the manufacturer, unless compliance is in doubt.

ICS 77.140.20; 77.140.50

Price based on 9 pages