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Cold-rolled stainless steel narrow strip — Tolerances on dimensions and form

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*Feuillards en acier inoxydable laminés à froid — Tolérances sur
dimensions et forme*

ISO 9447:1990

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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.

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.

International Standard ISO 9447 was prepared by Technical Committee ISO/TC 17, *Steel*.

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Cold-rolled stainless steel narrow strip — Tolerances on dimensions and form

1 Scope

1.1 This International Standard specifies the tolerances on dimensions and form for cold-rolled stainless steel¹⁾ narrow strip, in thicknesses of up to and including 3,00 mm and in rolling widths of less than 600 mm.

1.2 This International Standard also applies to cut lengths taken from the strip described in 1.1.

1.3 However, narrow strip and cut lengths with widths less than 600 mm, which are manufactured from wide strip by longitudinal slitting, are covered in ISO 9445.

1.4 For cold-rolled flat products of stainless steels in rolling widths of 600 mm and over, ISO 9445 applies.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 683-13:1986, *Heat-treatable steels, alloy steels and free-cutting steels — Part 13: Wrought stainless steels.*

ISO 683-16:1976, *Heat-treated steels, alloy steels and free-cutting steels — Part 16: Precipitation hardening stainless steels.*

ISO 4955:1983, *Heat-resisting steels and alloys.*

ISO/TR 4956:1984, *Wrought steels for use at elevated temperatures in engines.*

ISO 6929:1987, *Steel products — Definitions and classification.*

ISO 9445:1990, *Cold-rolled stainless steel wide strip and sheet — Tolerances on dimensions and form.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 stainless steels: Steels with a carbon content of up to and including 1,2 % and a chromium content of 10,5 % and over.

NOTE 1 This definition covers the ferritic, martensitic and austenitic steels of ISO 683-13 and ISO 683-16, also the heat-resisting steels of ISO 4955, and some of the creep-resisting steels of ISO/TR 4956.

3.2 cold-rolled flat products: Products which, during finishing, have undergone a reduction in cross-section of at least 25 % by cold rolling without prior reheating. In the case of flat products of widths less than 600 mm and for certain qualities of special steel, levels of reduction of cross-section less than 25 % may be included.

3.3 product forms

The definitions given in ISO 6929 apply.

1) See 3.1.

4 Designation on ordering

For complete designation in the order the following should be stated in the sequence given:

- the denomination (strip or cut length);
- the number of this International Standard;
- the thickness in millimetres (if necessary accurate to two decimal places), including the code letter F or P if a fine or precision tolerance is required;
- the width in millimetres, including the code letter F or P if a fine or precision tolerance is required;
- for cut lengths, the length in millimetres, including the code letter N, F or P if an exact length is required [see 5.1 b)].

EXAMPLE 1

Strip ISO 9447 - 0,80 × 250

EXAMPLE 2

Cut length ISO 9447 - 1,20 P × 250 F × 3 000 F

5 Type of delivery

5.1 Cold-rolled flat products according to this International Standard can be supplied as

- a) narrow strip (coils with a width less than 600 mm, see 6.3);

- b) cut lengths, manufactured by cutting strip according to item a), in nominal lengths with normal tolerances (N), fine tolerances (F) or precision tolerances (P) (see table 1 and 6.4).

5.2 The tolerance limit options available for cold-rolled flat products, are given in table 1 (shape of edges, dimensional tolerances and tolerances on form).

5.2.1 Flat products with cut edges (CE) will have burrs caused by cutting. If special requirements are made for these edges, corresponding agreements will have to be made on ordering. In this case, the strip is deemed to be cut almost free of burr if the height of the burr is less than 10 % of the product thickness.

5.2.2 By special agreement and depending on the technical equipment of the supplier, flat products according to this International Standard can be delivered with special edges (SE), e.g. deburred or rounded edges.

5.3 If the purchaser does not specify which tolerance options are required, the products will be supplied with the "normal" tolerance limits and cut edges.

Table 1 — Available tolerance limit options for sizes and dimensional features of cold-rolled flat products

| Shape of product | Shape of edge ²⁾ | Available sizes and dimensional features ¹⁾ | | | | | | | | | Edge camber ⁶⁾ Normal tolerance |
|------------------|-----------------------------|--|----------------|-----------|---------------------|----------------|-----------|----------------------|----------------|-----------|---|
| | | Thickness ³⁾ | | | Width ⁴⁾ | | | Length ⁵⁾ | | | |
| | | Normal | Fine tolerance | Precision | Normal | Fine tolerance | Precision | Normal | Fine tolerance | Precision | |
| Strip | CE | X | F | P | X | F | P | — | — | — | X |
| | SE | X | F | P | 7) | 7) | 7) | — | — | — | X |
| Cut length | CE | X | F | P | X | F | P | N | F | P | X |
| | SE | X | F | P | 7) | 7) | 7) | N | F | P | X |

1) The normal tolerances marked with a cross (X) are those which are usually delivered. If delivery with a fine or precision tolerance is required, the indicated code letters must be used in ordering (see clause 4).

2) See 5.2.1, 5.2.2 and 5.3.

3) See 6.1 and table 2.

4) See 6.2 and table 3.

5) See 6.4.

6) See 6.5 and table 4.

7) See 6.2.3

6 Tolerances on dimensions and form

6.1 Thickness

The tolerances on thickness in the case of normal tolerances (N), fine tolerances (F) and precision tolerances (P) are given in table 2. See are given in table 2. See also 7.1.

6.2 Width

6.2.1 The values for the permissible oversize on nominal widths in the case of normal tolerances (N), fine tolerances (F) and precision tolerances (P) for strip with cut edges (CE) are given in table 3. Undersize on nominal widths is only permitted by special agreement (see 6.2.2).

6.2.2 By special agreement, strip with cut edges can be supplied with permissible undersizes on the nominal width. In this case, the values in table 3 apply as the oversize plus undersize range.

6.2.3 In the case of strip or cut lengths having special edges (SE) the values for width tolerances must be specially agreed upon.

6.3 Diameter of coils

According to the order, the diameters of coils are: 300 mm, 400 mm, 500 mm or 600 mm for a strip thicknesses up to and including 2 mm, and 400 mm, 500 mm or 600 mm for strip thicknesses over 2 mm.

6.4 Length (in the case of cut lengths)

When nominal lengths are between 1 000 mm and 4 000 mm, the following oversizes are permissible:

normal tolerances (N): 10 mm;

fine tolerances (F): 5 mm;

precision tolerances (P): 2 mm.

Undersize on nominal length is not normally permitted, but may be allowed by special agreement.

For specified lengths less than 1 000 mm or over 4 000 mm, the tolerances are to be agreed upon at the time of enquiry and order.

Table 2 — Thickness tolerances for nominal widths

Values in millimetres

| Nominal thickness | | Thickness tolerances for nominal widths ¹⁾ | | | | | | | | |
|----------------------|--------------------|---|--------------------|--------------------|---|-------------------|--------------------|---|-------------|-------------|
| | | Nominal width | | | | | | | | |
| | | less than 125 | | | equal to and over 125 and less than 250 | | | equal to and over 250 and less than 600 | | |
| equal to and over | less than | Normal | Fine tolerance | Precision | Normal | Fine | Precision | Normal | Fine | Precision |
| 0,10 0,15 | 0,10 | $\pm 0,1 \cdot d$ | $\pm 0,05 \cdot d$ | $\pm 0,04 \cdot d$ | $\pm 0,010$ | $\pm 0,1 \cdot d$ | $\pm 0,08 \cdot d$ | $\pm 0,020$ | $\pm 0,012$ | $\pm 0,010$ |
| | 0,15 | $\pm 0,010$ | $\pm 0,008$ | $\pm 0,005$ | $\pm 0,015$ | $\pm 0,012$ | $\pm 0,008$ | $\pm 0,020$ | $\pm 0,015$ | $\pm 0,010$ |
| | 0,20 | $\pm 0,015$ | $\pm 0,010$ | $\pm 0,008$ | $\pm 0,020$ | $\pm 0,012$ | $\pm 0,010$ | $\pm 0,025$ | $\pm 0,015$ | $\pm 0,012$ |
| 0,20 0,25 0,30 | 0,25 | $\pm 0,015$ | $\pm 0,012$ | $\pm 0,008$ | $\pm 0,020$ | $\pm 0,015$ | $\pm 0,010$ | $\pm 0,025$ | $\pm 0,020$ | $\pm 0,012$ |
| | 0,30 | $\pm 0,020$ | $\pm 0,015$ | $\pm 0,010$ | $\pm 0,025$ | $\pm 0,015$ | $\pm 0,012$ | $\pm 0,030$ | $\pm 0,020$ | $\pm 0,015$ |
| | 0,40 | $\pm 0,020$ | $\pm 0,015$ | $\pm 0,010$ | $\pm 0,025$ | $\pm 0,020$ | $\pm 0,012$ | $\pm 0,030$ | $\pm 0,025$ | $\pm 0,015$ |
| 0,40 0,50 0,60 | 0,50 | $\pm 0,025$ | $\pm 0,020$ | $\pm 0,012$ | $\pm 0,030$ | $\pm 0,020$ | $\pm 0,015$ | $\pm 0,035$ | $\pm 0,025$ | $\pm 0,018$ |
| | 0,60 | $\pm 0,030$ | $\pm 0,020$ | $\pm 0,012$ | $\pm 0,030$ | $\pm 0,025$ | $\pm 0,015$ | $\pm 0,040$ | $\pm 0,030$ | $\pm 0,020$ |
| | 0,80 | $\pm 0,030$ | $\pm 0,025$ | $\pm 0,015$ | $\pm 0,035$ | $\pm 0,030$ | $\pm 0,018$ | $\pm 0,040$ | $\pm 0,035$ | $\pm 0,025$ |
| 0,80 1,00 1,25 | 1,00 | $\pm 0,030$ | $\pm 0,025$ | $\pm 0,015$ | $\pm 0,040$ | $\pm 0,030$ | $\pm 0,020$ | $\pm 0,050$ | $\pm 0,035$ | $\pm 0,025$ |
| | 1,25 | $\pm 0,035$ | $\pm 0,030$ | $\pm 0,020$ | $\pm 0,045$ | $\pm 0,035$ | $\pm 0,025$ | $\pm 0,050$ | $\pm 0,040$ | $\pm 0,030$ |
| | 1,50 | $\pm 0,040$ | $\pm 0,030$ | $\pm 0,020$ | $\pm 0,050$ | $\pm 0,035$ | $\pm 0,025$ | $\pm 0,060$ | $\pm 0,045$ | $\pm 0,030$ |
| 1,50 2,00 2,50 | 2,00 | $\pm 0,050$ | $\pm 0,035$ | $\pm 0,025$ | $\pm 0,060$ | $\pm 0,040$ | $\pm 0,030$ | $\pm 0,070$ | $\pm 0,050$ | $\pm 0,035$ |
| | 2,50 | $\pm 0,050$ | $\pm 0,035$ | $\pm 0,025$ | $\pm 0,070$ | $\pm 0,045$ | $\pm 0,030$ | $\pm 0,080$ | $\pm 0,060$ | $\pm 0,040$ |
| | 3,00 ²⁾ | $\pm 0,060$ | $\pm 0,045$ | $\pm 0,030$ | $\pm 0,070$ | $\pm 0,050$ | $\pm 0,035$ | $\pm 0,090$ | $\pm 0,070$ | $\pm 0,045$ |

1) See 7.1.
2) Including 3,00 mm.

Table 3 — Permissible oversize on nominal width

Values in millimetres

| Nominal thickness | | Permissible oversize on nominal width ^{1) 2)} | | | | | | | | | | | |
|-------------------|--------------------|--|------|-----------|--|------|-----------|---|------|-----------|---|------|-----------|
| | | Nominal width | | | | | | | | | | | |
| | | less than 40 | | | equal to and over 40 and less than 125 | | | equal to and over 125 and less than 250 | | | equal to and over 250 and less than 600 | | |
| equal to and over | less than | Normal | Fine | Precision | Normal | Fine | Precision | Normal | Fine | Precision | Normal | Fine | Precision |
| | 0,25 | 0,25 | 0,15 | 0,12 | 0,25 | 0,20 | 0,15 | 0,40 | 0,30 | 0,25 | 0,60 | 0,50 | 0,40 |
| 0,25 | 0,50 | 0,30 | 0,20 | 0,12 | 0,30 | 0,25 | 0,15 | 0,50 | 0,30 | 0,25 | 0,60 | 0,50 | 0,40 |
| 0,50 | 1,00 | 0,30 | 0,20 | 0,15 | 0,40 | 0,30 | 0,20 | 0,50 | 0,40 | 0,30 | 0,80 | 0,60 | 0,50 |
| 1,00 | 2,00 | 0,40 | 0,30 | 0,20 | 0,50 | 0,40 | 0,30 | 0,80 | 0,60 | 0,50 | 1,00 | 0,80 | 0,60 |
| 2,00 | 3,00 ³⁾ | 0,50 | 0,40 | 0,30 | 0,70 | 0,50 | 0,40 | 1,00 | 0,80 | 0,60 | 1,20 | 1,00 | 0,80 |

1) Applicable to flat products with cut edges (see also 6.2.2 and 6.2.3).
 2) By agreement, ± tolerances with the same total tolerance range can be delivered.
 3) Including 3,00 mm.

6.5 Edge camber tolerances

7 Measurement of dimensions

6.5.1 The edge camber tolerances are given in table 4 (see 7.2).

7.1 Thickness

6.5.2 Table 4 does not apply to work-hardened products and special agreements must be made for this type of condition.

The thickness may be measured at any arbitrarily chosen point on the product at least 10 mm from the edges. For widths up to and including 20 mm, it shall be measured at the centre of the product width.

Table 4 — Edge camber tolerances

Values in millimetres

When ordering fine (F) or precision (P) thickness tolerances, it can be agreed that the permissible deviations from thickness shall be maintained over the whole width of the product.

7.2 Edge camber

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 1).

In the case of strip, testing shall be carried out at a minimum distance of 3 000 mm from the beginning or end of the coil.

7.3 Flatness

Tolerances can be measured in the following ways.

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

6.6 Flatness

6.6.1 The flatness tolerance for cut lengths shall be up to and including 10 mm (see also 6.6.2 and 7.3).

6.6.2 The requirement in 6.6.1 does not apply to work-hardened products and special agreements must be made for this type of condition.

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 1000 mm or 2000 mm. It may be placed

on the product at any position and in any direction. Only the position between the points of contact of plate and straight-edge shall be taken into account.

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

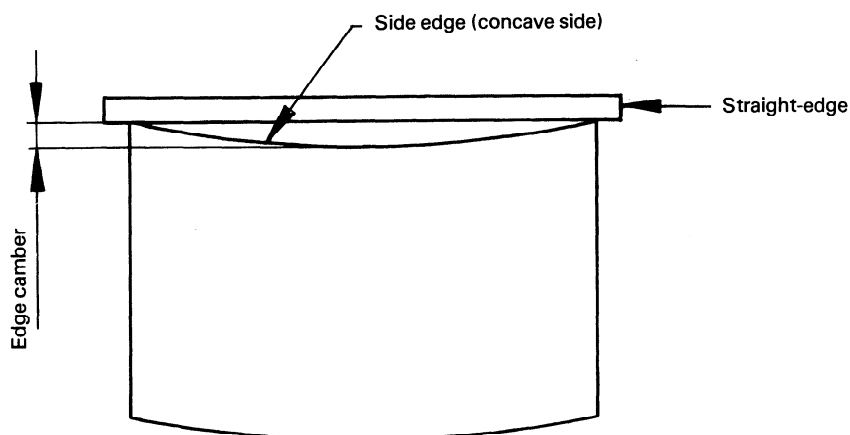


Figure 1 — Measurement of edge camber

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