BS EN 10051:2010

BSI Standards Publication

Continuously hot-rolled strip and plate/sheet cut from wide strip of non-alloy and alloy steels — Tolerances on dimensions and shape

National foreword

This British Standard is the UK implementation of EN 10051:2010. It supersedes BS EN 10051:1991+A1:1997 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee ISE/103, Structural Steels Other Than Reinforcements.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

ISBN 978 0 580 67084 8

ICS 77.140.50

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 December 2010.

Amendments issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 10051

November 2010

ICS 77.140.50

Supersedes EN 10051:1991 + A1:1997

English Version

Continuously hot-rolled strip and plate/sheet cut from wide strip of non-alloy and alloy steels - Tolerances on dimensions and shape

Bandes laminées à chaud en continu, bandes et tôles issues de larges bandes laminées à chaud en aciers alliés et non alliés - Tolérances sur les dimensions et la forme

Kontinuierlich warmgewalztes Band und Blech abgelängt aus Warmbreitband aus unlegierten und legierten Stählen - Grenzabmaße und Formtoleranzen

This European Standard was approved by CEN on 23 October 2010.

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EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 10051:2010: E

Contents

Page

Foreword

This document (EN 10051:2010) has been prepared by Technical Committee ECISS/TC 103 “Structural steels other than reinforcements”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2011, and conflicting national standards shall be withdrawn at the latest by May 2011.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 10051:1991+A1:1997.

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1 Scope

This European Standard specifies tolerances on dimensions and shape for continuously hot-rolled uncoated plate/sheet and strip with a maximum width of 2 200 mm of non-alloy and alloy steels in accordance with Table 1 (see also Annex A). This European Standard also applies to hot-rolled strip for cold rolling.

Table 1 — Field of application

Product	Thickness mm	Steel grades according to: (but not limited to)
wide strip (width: 600 mm ≤ w ≤ 2 200 mm), Sheet/Plate cut from wide strip, strip w < 600 mm slit from wide strip	≤ 25 mm	EN 10025-2 to -6, EN 10028-2 to -6, EN 10083-2 and -3, EN 10084, EN 10085, EN 10111, EN 10120, EN 10149-2 and -3, EN 10207, prEN 10338, EN ISO 4957.

This European Standard does not apply to stainless steels and not to hot-rolled strip rolled in widths w < 600 mm (see EN 10048).

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.

EN 10020, *Definition and classification of grades of steel*

EN 10048, *Hot-rolled narrow steel strip — Tolerances on dimensions and shape*

EN 10079*, Definition of steel products*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
non-alloy and alloy steels
see EN 10020

3.2
wide strip and sheet/plate
see EN 10079

3.3
crown
difference in thickness between one of the edges and the centre of a rolled product

4 Information to be supplied by the purchaser

4.1 General

The following information shall be supplied by the purchaser at the time of enquiry and order:

a) the quantity to be delivered;

b) designation of the product (wide strip, sheet/plate cut from wide strip, strip slit from wide strip);

c) number of this dimensional standard (EN 10051);

d) nominal thickness and width in mm;

e) the letters GK if strip and sheet/plate with trimmed edges is ordered (see 5.1);

f) nominal length in mm (for sheet and plate);

g) width tolerances for sheet/plate with thickness > 10 mm (see 6.3);

h) tolerances on flatness for sheet/plate of category D (see 6.4.2 and Table 10);

i) edge camber requirements for strip < 600 mm wide, which was slit from wide strip (see 7.5).

4.2 Options

A number of options are specified in Annex B. In the event that the purchaser does not indicate his wish to implement any of these options, the supplier shall supply in accordance with the basic specification (see 4.1 and 5.1).

4.3 Designation

EXAMPLE 1 20 sheets according to this European Standard with nominal thickness of 2,0 mm, nominal width 1 200 mm, with trimmed edges (GK), nominal length 2 500 mm of steel 34Cr4 (1.7033) as specified in EN 10083-3:

20 sheets EN 10051 – 2,0 x 1 200GK x 2 500
steel EN 10083-3 – 34Cr4

EXAMPLE 2 5 t of strip according to this European Standard with nominal thickness of 4,5 mm, nominal width 1 500 mm, with mill edges of steel S235JR (1.0038), as specified in EN 10025-2:

5 t strip EN 10051 – 4,5 x 1 500
steel EN 10025-2 – S235JR

5 Form of supply

5.1 Sheet/plate and strip shall be supplied with mill edges or with trimmed edges (GK), as agreed at the time of enquiry and order (see Annex B, option a)). In the absence of information on the form of supply, sheet/plate and strip shall be supplied with mill edges.

5.2 The possibility of delivering coils with welding seams can be agreed at the time of enquiry and order. The indication of the location of the weld can be agreed at the same time (see Annex B, option b)).

5.3 Where no specific choice is made by the purchaser concerning points g), h), and i) of 4.1 is given by the purchaser, the supplier shall refer back to the purchaser.

6 Tolerances for sheet/plate

6.1 Thickness

6.1.1 The tolerances on thickness for continuously hot-rolled low carbon steel sheet/plate for cold forming according to EN 10111 are given in Table 2.

Table 2 — Tolerances on thickness for hot-rolled low carbon steel sheet/plate and strip for cold forming

Dimensions in mm

Nominal thickness t	Tolerances for a nominal width w			
	$w \leq 1\,200$	$1\,200 < w \leq 1\,500$	$1\,500 < w \leq 1\,800$	$w > 1\,800$
$t \leq 2{,}00$	±0,13	±0,14	±0,16	–
$2{,}00 < t \leq 2{,}50$	±0,14	±0,16	±0,17	±0,19
$2{,}50 < t \leq 3{,}00$	±0,15	±0,17	±0,18	±0,20
$3{,}00 < t \leq 4{,}00$	±0,17	±0,18	±0,20	±0,20
$4{,}00 < t \leq 5{,}00$	±0,18	±0,20	±0,21	±0,22
$5{,}00 < t \leq 6{,}00$	±0,20	±0,21	±0,22	±0,23
$6{,}00 < t \leq 8{,}00$	±0,22	±0,23	±0,23	±0,26
$8{,}00 < t \leq 11{,}00$	±0,24	±0,25	±0,25	±0,28

6.1.2 The tolerances on thickness for steels, not covered by 6.1.1, are given in Tables 3 to 6. These tolerances are indicated as categories A, B, C, D. The dimensional tolerances of steel grades which do not have a specified minimum yield strength are the ones of category D.

Table 3 — Tolerances on thickness for strip and sheet/plate of steels with a specified minimum yield strength $R_e \leq 300$ MPa (category A)

Dimensions in mm

Nominal thickness t	Tolerances for a nominal width w			
	$w \leq 1\,200$	$1\,200 < w \leq 1\,500$	$1\,500 < w \leq 1\,800$	$w > 1\,800$
$t \leq 2{,}00$	±0,17	±0,19	±0,21	–
$2{,}00 < t \leq 2{,}50$	±0,18	±0,21	±0,23	±0,25
$2{,}50 < t \leq 3{,}00$	±0,20	±0,22	±0,24	±0,26
$3{,}00 < t \leq 4{,}00$	±0,22	±0,24	±0,26	±0,27
$4{,}00 < t \leq 5{,}00$	±0,24	±0,26	±0,28	±0,29
$5{,}00 < t \leq 6{,}00$	±0,26	±0,28	±0,29	±0,31
$6{,}00 < t \leq 8{,}00$	±0,29	±0,30	±0,31	±0,35
$8{,}00 < t \leq 10{,}00$	±0,32	±0,33	±0,34	±0,40
$10{,}00 < t \leq 12{,}50$	±0,35	±0,36	±0,37	±0,43
$12{,}50 < t \leq 15{,}00$	±0,37	±0,38	±0,40	±0,46
$15{,}00 < t \leq 25{,}00$	±0,40	±0,42	±0,45	±0,50

Table 4 — Tolerances on thickness for strip and sheet/plate of steels with a specified minimum yield strength 300 MPa < R_e ≤ 360 MPa (category B)

Dimensions in mm

Nominal thickness t	Tolerances for a nominal width w			
	w ≤ 1 200	1 200 < w ≤ 1 500	1 500 < w ≤ 1 800	w > 1 800
t ≤ 2,00	±0,20	±0,22	±0,24	–
2,00 < t ≤ 2,50	±0,21	±0,24	±0,26	±0,29
2,50 < t ≤ 3,00	±0,23	±0,25	±0,28	±0,30
3,00 < t ≤ 4,00	±0,25	±0,28	±0,30	±0,31
4,00 < t ≤ 5,00	±0,28	±0,30	±0,32	±0,33
5,00 < t ≤ 6,00	±0,30	±0,32	±0,33	±0,36
6,00 < t ≤ 8,00	±0,33	±0,35	±0,36	±0,40
8,00 < t ≤ 10,00	±0,37	±0,38	±0,39	±0,46
10,00 < t ≤ 12,50	±0,40	±0,41	±0,43	±0,49
12,50 < t ≤ 15,00	±0,43	±0,44	±0,46	±0,53
15,00 < t ≤ 25,00	±0,46	±0,48	±0,52	±0,58

Table 5 — Tolerances on thickness for strip and sheet/plate of steels with a specified minimum yield strength 360 MPa < R_e ≤ 420 MPa (category C)

Dimensions in mm

Nominal thickness t	Tolerances for a nominal width w			
	w ≤ 1 200	1 200 < w ≤ 1 500	1 500 < w ≤ 1 800	w > 1 800
t ≤ 2,00	±0,22	±0,25	±0,27	–
2,00 < t ≤ 2,50	±0,23	±0,27	±0,30	±0,33
2,50 < t ≤ 3,00	±0,26	±0,29	±0,31	±0,34
3,00 < t ≤ 4,00	±0,29	±0,31	±0,34	±0,35
4,00 < t ≤ 5,00	±0,31	±0,34	±0,36	±0,38
5,00 < t ≤ 6,00	±0,34	±0,36	±0,38	±0,40
6,00 < t ≤ 8,00	±0,38	±0,39	±0,40	±0,46
8,00 < t ≤ 10,00	±0,42	±0,43	±0,44	±0,52
10,00 < t ≤ 12,50	±0,46	±0,47	±0,48	±0,56
12,50 < t ≤ 15,00	±0,48	±0,49	±0,52	±0,60
15,00 < t ≤ 25,00	±0,52	±0,55	±0,59	±0,65

Table 6 — Tolerances on thickness for strip and sheet/plate of steels with a specified minimum yield strength 420 MPa < R_e ≤ 900 MPa (category D)

Dimensions in mm

Nominal thickness t	Tolerances for a nominal width w			
	$w \leq 1\,200$	$1\,200 < w \leq 1\,500$	$1\,500 < w \leq 1\,800$	$w > 1\,800$
$t \leq 2{,}00$	±0,24	±0,27	±0,29	–
$2{,}00 < t \leq 2{,}50$	±0,25	±0,29	±0,32	±0,35
$2{,}50 < t \leq 3{,}00$	±0,28	±0,31	±0,34	±0,36
$3{,}00 < t \leq 4{,}00$	±0,31	±0,34	±0,36	±0,38
$4{,}00 < t \leq 5{,}00$	±0,34	±0,36	±0,39	±0,41
$5{,}00 < t \leq 6{,}00$	±0,36	±0,39	±0,41	±0,43
$6{,}00 < t \leq 8{,}00$	±0,41	±0,42	±0,43	±0,49
$8{,}00 < t \leq 10{,}00$	±0,45	±0,46	±0,48	±0,56
$10{,}00 < t \leq 12{,}50$	±0,49	±0,50	±0,52	±0,60
$12{,}50 < t \leq 15{,}00$	±0,52	±0,53	±0,56	±0,64
$15{,}00 < t \leq 25{,}00$	±0,56	±0,59	±0,63	±0,70

6.2 Length

The tolerances on length for sheet/plate shall be as given in Table 7.

Table 7 — Tolerances on length for sheet/plate

Dimensions in mm

Nominal length	Tolerances	
l	Lower	Upper
$l < 2\,000$	0	+10
$2\,000 \leq l < 8\,000$	0	+0,005 x l
$l \geq 8\,000$	0	+40

6.3 Width

The tolerances on width for sheet/plate shall be as given in Table 8.

Table 8 — Tolerances on width for sheet/plate

Dimensions in mm

Nominal width w	Tolerances			
	Mill edges		Trimmed edges[a]	
	Lower	Upper	Lower	Upper
$w \leq 1\,200$	0	+20	0	+3
$1\,200 < w \leq 1\,850$	0	+20	0	+5
$w > 1\,850$	0	+25	0	+6

[a] Tolerances for trimmed edges apply to products with nominal thickness $t \leq 10$ mm; for nominal thickness $t > 10$ mm the upper tolerances shall be agreed at the time of enquiry and order.

6.4 Flatness

6.4.1 For continuously hot-rolled low carbon sheet/plate of steels with a specified minimum yield strength $R_e \leq 300$ MPa (category A) the deviation from flatness shall not exceed the tolerances given in Table 9.

Closer flatness tolerances shall be agreed at the time of enquiry and order (see Annex B, option c)).

Table 9 — Tolerances on flatness for steels with a specified minimum yield strength $R_e \leq 300$ MPa (category A)

Dimensions in mm

Nominal thickness t	Nominal width w	Tolerances on flatness	Special tolerances on flatness
$t \leq 2{,}00$	$w \leq 1\,200$	18	9
	$1\,200 < w \leq 1\,500$	20	10
	$w > 1\,500$	25	13
$2{,}00 < t \leq 25$	$w \leq 1\,200$	15	8
	$1\,200 < w \leq 1\,500$	18	9
	$w > 1\,500$	23	12

6.4.2 For continuously hot-rolled low carbon sheet/plate of steels with a specified minimum yield strength 300 MPa $< R_e \leq$ 900 MPa (categories B,C and D) the deviation from flatness shall not exceed the tolerances given in Table 10.

Closer tolerances for categories B and C shall be agreed at the time of enquiry and order (see Annex B, option d)).

Table 10 — Tolerances on flatness for steels with a specified minimum yield strength 300 MPa < R_e ≤ 900 MPa (categories B, C and D)

Dimensions in mm

Nominal thickness t	Nominal width w	Tolerances on flatness for category [a]		
		B	C	D
$t \leq 25$	$w \leq 1\,200$	18	23	shall be agreed at the time of enquiry and order
	$1\,200 < w \leq 1\,500$	23	30	
	$w > 1\,500$	28	38	

[a] The categories B, C and D are defined in 6.1.2 and Tables 4 to 6.

6.5 Edge camber

The edge camber shall not exceed 0,5 % of the actual length of the sheet/plate for a nominal length $l < 5\,000$ mm.

For sheet/plate with a nominal length $l \geq 5\,000$ mm and widths $w \geq 600$ mm, the edge camber shall not exceed 20 mm for any length of 5 000 mm in the case of sheet/plate with mill edges and 15 mm in the case of sheet with trimmed edges.

6.6 Out-of-squareness

The out-of-squareness u measured in accordance with 8.7 shall not exceed 1,0 % of the actual width of the sheet/plate.

6.7 Superimposement of dimensions

By agreement at the time of enquiry and order the upper tolerances on out-of-squareness and edge camber may be replaced by a requirement that a perfect rectangle formed by the ordered width and length dimensions can be superimposed into the sheets delivered (see Annex B, option e)). In this case, the upper tolerances on width and length shall be agreed at the time of enquiry and order.

7 Tolerances for wide strip and strip split from wide strip

7.1 General

The specified values for tolerances shall not apply to the uncropped ends of the coil for a total length l, which is calculated using the formula.

$$l\,(\mathrm{m}) = \frac{90}{\textit{nominal thickness (mm)}}$$

provided that the result does not exceed 20 m.

7.2 Thickness

7.2.1 The tolerances on thickness shall be the same as those for sheet/plate (see 6.1).

7.2.2 Maximum values for crown as given in Table 11 and permissible thickness differences within one coil as given in Table 12 shall apply for hot-rolled strip for cold rolling, if agreed at the time of enquiry and order (see Annex B, option f)). The thickness (within one coil) shall change gradually and the changes shall not be discontinuous.

NOTE For coils not slit in longitudinal direction the crown should be aimed to be as constant and symmetrical from the middle of the coil as possible.

7.2.3 More severe tolerances on thickness and crown may be agreed at the time of enquiry and order (see Annex B, option g)).

Table 11 — Maximum values for crown for hot-rolled strip for cold rolling

Dimensions in mm

Nominal width w	**Permissible crown for steel category** [a]			
	A	B	C	D
$w \leq 1\,200$	0,10	0,12	0,13	0,14
$1\,200 < w \leq 1\,500$	0,13	0,15	0,17	0,18
$1\,500 < w \leq 1\,800$	0,16	0,18	0,21	0,22
$1\,800 < w \leq 2\,200$	0,20	0,23	0,26	0,28
[a] The values for permissible crown shall be lowered by 20 % for hot-rolled strip slit from wide strip meant for cold rolling.				

Table 12 — Permissible thickness differences within one coil of hot-rolled strip coil for cold rolling

Dimensions in mm

Nominal thickness t	**Permissible thickness differences for nominal width of strip**		
	$w \leq 1\,200$	$1\,200 < w \leq 1\,500$	$1\,500 < w \leq 2\,200$
$0,8 \leq t \leq 2,0$	0,20	0,24	0,28
$2,0 < t \leq 3,0$	0,22	0,27	0,33
$3,0 < t \leq 4,0$	0,28	0,32	0,40
$4,0 < t \leq 8,0$	0,28	0,32	0,40

7.3 Width

The tolerances on width for strip shall be the same as for sheet/plate (see 6.3).

7.4 Flatness

Requirements concerning flatness shall be agreed at the time of enquiry and order.

Any requirements agreed shall take into account the processing equipment at the user's disposal.

7.5 Edge camber

For strip w ≥ 600 mm, the edge camber shall not exceed 20 mm for any length of 5 000 mm in the case of strip with mill edges and 15 mm in the case of strip with trimmed edges.

For strip w < 600 mm slit from wide strip, the tolerances on edge camber shall be agreed at the time of enquiry and order.

8 Measurement

8.1 General

Measurements listed in 8.2 to 8.7 shall be used in case of dispute and be carried out at ambient temperature.

8.2 Thickness

8.2.1 The thickness shall be measured at any point situated at least 40 mm from the edges for products with mill edges and at least 25 mm from the edges for products with trimmed/slit edges. For coils with uncropped ends, 7.1 shall be considered.

8.2.2 The crown shall be measured as the thickness difference between the centre line of the product and a measuring point at 40 mm from any edge of the product in case of mill edges and at 25 mm in case of trimmed/slit edges.

8.2.3 The difference in thickness within one coil shall be measured at a line with an invariable distance from the longitudinal edges (minimum distance from the edges in accordance with 8.2.1).

8.3 Length of sheet/plate

The length of the sheet/plate is the length of the shorter of both longitudinal edges.

8.4 Width

The width shall be measured at right angles to the longitudinal axis of the product.

8.5 Flatness for sheet/plate

Deviation from flatness for sheet/plate shall be determined by measuring the deviation in distance between the product and a flat horizontal surface on which it is placed.

8.6 Edge camber

The edge camber is the maximum deviation of a longitudinal edge from a straight edge measuring base applied to it.

The camber is measured on the concave edge (see Figure 1).

For sheet/plate measuring base shall be the length of the product for a nominal length l < 5 000 mm.

For strip and sheet/plate with a nominal length l ≥ 5 000 mm, the measuring base shall be 5 000 mm, taken anywhere along the edge but excluding the uncropped ends.

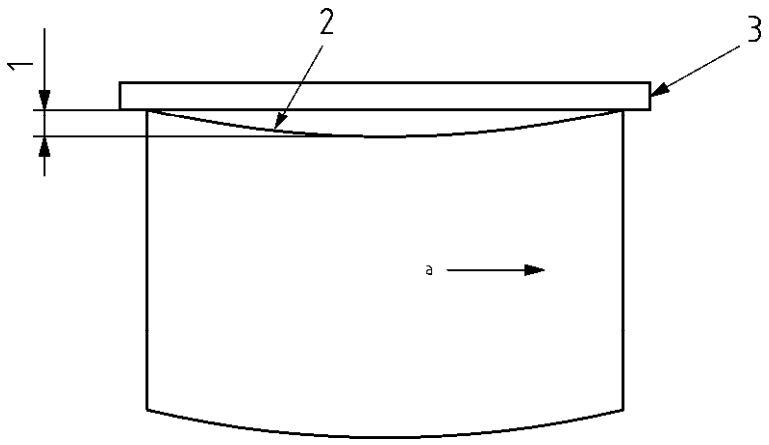


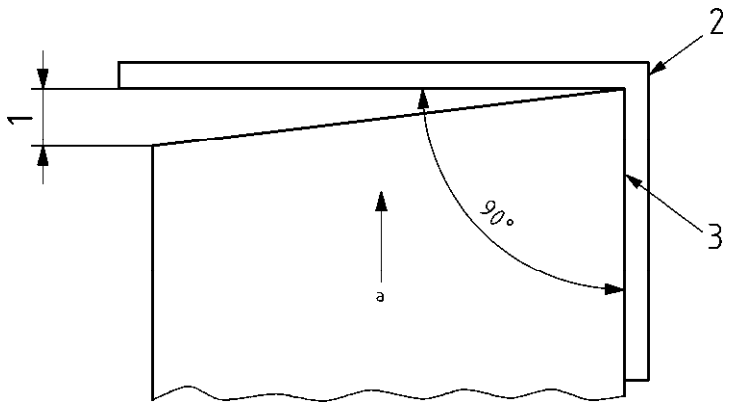
Figure 1 — Measurement of edge camber

Key

1 Edge Camber
2 Side edge (concave side)
3 Straight edge
a Rolling direction

8.7 Out-of-squareness for sheet/plate

The out-of-squareness u for sheet/plate is the orthogonal projection of a transverse edge over a longitudinal edge (see Figure 2).



Key

1 Out-of squareness u
2 Square
3 Side edge
a Rolling direction

Figure 2 — Measurement of out-of-squareness

Annex A
(informative)

Standards with steel grades for this dimensional standard

EN 10025-2, *Hot rolled products of structural steels — Part 2: Technical delivery conditions for non-alloy structural steels*

EN 10025-3, *Hot rolled products of structural steels — Part 3: Technical delivery conditions for normalized/normalized rolled weldable fine grain structural steels*

EN 10025-4, *Hot rolled products of structural steels — Part 4: Technical delivery conditions for thermomechanical rolled weldable fine grain structural steels*

EN 10025-5, *Hot rolled products of structural steels — Part 5: Technical delivery conditions for structural steels with improved atmospheric corrosion resistance*

EN 10025-6:2004+A1:2009*, Hot rolled products of structural steels — Part 6: Technical delivery conditions for flat products of high yield strength structural steels in the quenched and tempered condition*

EN 10028-2*, Flat products made of steels for pressure purposes — Part 2: Non-alloy and alloy steels with specified elevated temperature properties*

EN 10028-3, *Flat products made of steels for pressure purposes — Part 3: Weldable fine grain steels, normalized*

EN 10028-4*, Flat products made of steels for pressure purposes — Part 4: Nickel alloy steels with specified low temperature properties*

EN 10028-5*, Flat products made of steels for pressure purposes — Part 5: Weldable fine grain steels, thermomechanically rolled*

EN 10028-6*, Flat products made of steels for pressure purposes — Part 6: Weldable fine grain steels, quenched and tempered*

EN 10083-2, *Steels for quenching and tempering — Part 2: Technical delivery conditions for non-alloy steels*

EN 10083-3, *Steels for quenching and tempering — Part 3: Technical delivery conditions for alloy steels*

EN 10084, *Case hardening steels — Technical delivery conditions*

EN 10085, *Nitriding steels — Technical delivery conditions*

EN 10111, *Continuously hot-rolled low carbon steel sheet and strip for cold forming — Technical delivery conditions*

EN 10120*, Steel sheet and strip for welded gas cylinders*

EN 10149-2, *Hot rolled flat products made of high yield strength steels for cold forming — Part 2: Delivery conditions for thermomechanically rolled steels*

EN 10149-3, *Hot-rolled flat products made of high yield strength steels for cold forming — Part 3: Delivery conditions for normalized or normalized rolled steels*

EN 10207, *Steels for simple pressure vessels — Technical delivery requirements for plates, strips and bars*

prEN 10338:2007, *Hot rolled and cold rolled non-coated flat products of multiphase steels for cold forming — Technical delivery conditions*

EN ISO 4957, *Tool steels (ISO 4957:1999)*

Annex B
(normative)

Options

A number of options (see 4.2) are specified in this European Standard and listed below. If the purchaser does not indicate his wish to implement any of these options, the supplier shall supply in accordance with the basic specification of this European standard (see 4.1 and 5.1):

a) whether trimmed edges are required (see 5.1);

b) whether coils may be delivered with welded seams (see 5.2);

c) whether for sheet/plate with a specified minimum yield strength R_e ≤ 300 MPa (category A) closer tolerances on flatness are required (see 6.4.1);

d) whether for sheet/plate with a specified minimum yield strength 300 MPa < R_e ≤ 420 MPa (categories B and C) closer tolerances on flatness are required (see 6.4.2);

e) whether for sheet/plate the tolerances on out-of-squareness and edge camber shall be replaced by a requirement that a perfect rectangle formed by the ordered width and length dimensions can be superimposed into the sheets delivered (see 6.7);

f) whether for hot-rolled-strip for cold rolling, maximum values for crown according to Table 11 and permissible thickness differences within one coil according to Table 12 are required (see 7.2.2);

g) whether for strip more severe tolerances on thickness and crown are required (see 7.2.3);

h) whether flatness requirements for wide strip and strip < 600 mm wide slit from strip are required (see 7.4).

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