

HOT-ROLLED STEEL PLATES, SHEETS AND COILS

Dimensional and shape tolerances

- **Scope**

The dimensional and shape tolerances of steel are determined by the requirements of the materials standard or the data sheet of the steel grade in question. This technical brochure specifies the dimensional and shape tolerances of Ruukki's steel grades for each product form. The technical brochure applies to steel grades in the hot-rolled, normalized rolled, furnace normalized, thermo-mechanically rolled, hardened or quenched and tempered condition. Selected tolerance values of Ruukki's special steels are more exact than the tolerances set in standards. So, it is recommended to check the special steels' tolerances on the product data on the web www.ruukki.com.

- **Standards and norms**

The dimensional and shape tolerances of steel grades for each product form are based on the following standards or norms:

- Heavy plates (plates): EN 10029¹⁾
- Cut lengths (sheets), wide coils and slit strips: EN 10051²⁾
- Patterned plates: DIN 59220³⁾, SEL 014E:1979⁴⁾, SFS 5500⁵⁾ or ASTM A786⁶⁾

If the customer does not specify the tolerance required when making the order, Ruukki applies the tolerances of the appropriate materials standard or this technical brochure.

¹⁾ EN 10029:2010

Hot-rolled steel plates 3 mm thick or above. Tolerances on dimensions and shape

²⁾ EN 10051:2010

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

³⁾ DIN 59220:2000.

Flacherzeugnisse aus Stahl - Warmgewalztes Blech mit Mustern - Masse, Gewichte, Grenzabmasse, Formtoleranzen und Grenzabweichungen der Masse.

Flat products of steel - Hot rolled patterned plate - Dimensions, mass, tolerances on dimensions, shape and mass.

⁴⁾ SEL 014E:1979 (Stahl- Eisen-Lieferbedingungen) Warmbreitband mit Mustern. Masse, Gewichte, zulässige Abweichungen.

⁵⁾ SFS 5500:2005

Hot rolled patterned plates. Dimensions and tolerances.

⁶⁾ ASTM A786:2009

Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.

EN 10111:2008

Continuously hot rolled low carbon steel sheet and strip for cold forming. Technical delivery conditions.

● **Plates**

The dimensional and shape tolerances for heavy plates are given in table 1. The tolerances are in compliance with standard EN 10029, however, the tolerances for flatness of all the heavy plates manufactured by Ruukki, are stricter than those of standard requirements. Class A thickness tolerances are applied to structural steels and class B thickness tolerances to pressure equipment steels, unless otherwise agreed upon.

Table 1.
Dimensional and Shape Tolerances. Plates

Thickness tolerances ¹⁾

Nominal thickness mm	Tolerances for nominal thickness mm							
	Class A		Class B		Class C		Class D	
	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper
4.7 – (5)	-0.3	+0.7	-0.3	+0.7	0	+1.0	-0.5	+0.5
5 – (8)	-0.4	+0.8	-0.3	+0.9	0	+1.2	-0.6	+0.6
8 – (15)	-0.5	+0.9	-0.3	+1.1	0	+1.4	-0.7	+0.7
15 – (25)	-0.6	+1.0	-0.3	+1.3	0	+1.6	-0.8	+0.8
25 – (40)	-0.7	+1.3	-0.3	+1.7	0	+2.0	-1.0	+1.0
40 – (80)	-0.9	+1.7	-0.3	+2.3	0	+2.6	-1.3	+1.3
80 – (150)	-1.1	+2.1	-0.3	+2.9	0	+3.2	-1.6	+1.6

¹⁾ Description of the Thickness tolerance Classes according to EN 10029.

- Class A: Both lower and upper tolerance values depend on the plate thickness.
- Class B: Lower tolerance is fixed to be = -0.3 mm, whereas upper tolerance depends on the thickness.
- Class C: Lower tolerance is fixed to be = 0.0 mm, whereas upper tolerance depends on the thickness.
- Class D: Symmetrical tolerances i.e. lower and upper tolerance values are equal.

Width tolerances

Nominal thickness mm	Tolerances	
	Lower allowance mm	Upper allowance mm
<40	0	+20
40 – (150)	0	+25
150 –	0	+30

Length tolerances

Nominal length mm	Tolerances	
	Lower allowance mm	Upper allowance mm
< 4000	0	+20
4000 – (6000)	0	+30
6000 – (8000)	0	+40
8000 – (10000)	0	+50
10000 – (15000)	0	+75
15000 – 20000	0	+100

Geometry

Edge camber and out-of-squareness	The edge camber and out-of-squareness of a plate shall be limited so that it shall be possible to inscribe a rectangle of the size of the ordered plate within the delivered flat.
Flatness	The normal tolerance for plate flatness is 6 mm/m (plate thickness below 40 mm) and 5 mm/m (plate thickness 40 mm and more). By separate agreement, plates can be delivered with stricter flatness tolerance (special tolerances on flatness, class S EN 10029).

• **Coils and slit strip**

The dimensional and shape tolerances for coils and slit strips are given in tables 2 and 3. The tolerances are in compliance with standard EN 10051. Coils and slit strip delivered by Ruukki have smaller width tolerances than those indicated in the standard. If a delivery of cut lengths with sheared edges is required, the letters GK must be appended to the width dimension. Slit strips are always delivered with sheared edges.

Table 2.

Dimensional and shape tolerances.

EN 10111, Hot rolled low carbon steel sheet and strip for cold forming, $R_{eH} = 170 - 360$ MPa. Coils and slit strips

Thickness tolerances

Tolerances for nominal thickness mm				
Nominal thickness mm	Width mm			
	≤ 1200 EN 10051	> 1200 ≤ 1500 EN 10051	> 1500 ≤ 1800 EN 10051	> 1800 EN 10051
≤ 2.00	±0.13	±0.14	±0.16	–
(2.00) ≤ 2.50	±0.14	±0.16	±0.17	±0.19
(2.50) ≤ 3.00	±0.15	±0.17	±0.18	±0.20
(3.00) ≤ 4.00	±0.17	±0.18	±0.20	±0.20
(4.00) ≤ 5.00	±0.18	±0.20	±0.21	±0.22
(5.00) ≤ 6.00	±0.20	±0.21	±0.22	±0.23
(6.00) ≤ 8.00	±0.22	±0.23	±0.23	±0.26
(8.00) ≤ 11.00	±0.24	±0.25	±0.25	±0.28

Width tolerances

Tolerances for nominal width mm											
Ruukki						EN 10051					
Mill edges			Sheared edges GK			Nominal width		Mill edges		Sheared edges GK ¹⁾	
Nominal width	Lower	Upper	Nominal thickness	Lower	Upper		Lower	Upper	Lower	Upper	
≤ 1200	0	+20	≤ 4.99	0	+1.0	≤ 1200	0	+20	0	+3	
> 1200	0	+20	≥ 5.00	0	+1.0	> 1200 ≤ 1850	0	+20	0	+5	
–	–	–	–	–	–	> 1850	0	+25	0	+6	

The values given in the table for tolerances on thickness and width are not valid for the end sections, of length L. L is derived from the formula $L(m) = 90/\text{nominal thickness (mm)}$; the total length of the two ends but not over 20 m.

¹⁾ The tolerances for coils and slit strip with sheared edges are valid for nominal thicknesses ≤ 10 mm. For nominal thicknesses > 10 mm, the upper allowance is to be agreed in connection of the order.

Geometry

Ruukki	Mill edges	Sheared edges GK
Flatness	Requirements concerning flatness can be agreed at the time of enquiry and order.	Requirements concerning flatness can be agreed at the time of enquiry and order.
Straightness Maximum permissible deviation from a straight line	10 mm/6 m	10 mm/6 m

Measurements


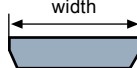
Measurement of thickness	> 40 mm from edge	> 25 mm from edge
Coil telescoping	≤ 60 mm	≤ 60 mm
Measurement of width Width is measured at straight angles to the longitudinal edges of the flat		

Table 3.
Dimensional and shape tolerances. All steel grades (except EN 10111) and all yield strength classes $R_{eH} \leq 900$ MPa.
Coils and slit strip

Thickness tolerances ¹⁾

Tolerances for nominal thickness mm								
Nominal thickness mm	Width mm ≤ 1200		$> 1200 \leq 1500$		$> 1500 \leq 1800$		> 1800	
	Ruukki	EN 10051	Ruukki	EN 10051	Ruukki	EN 10051	Ruukki	EN 10051
≤ 2.00	± 0.13	± 0.17	± 0.14	± 0.19	± 0.16	± 0.21	–	–
$(2.00) \leq 2.50$	± 0.14	± 0.18	± 0.16	± 0.21	± 0.17	± 0.23	± 0.19	± 0.25
$(2.50) \leq 3.00$	± 0.15	± 0.20	± 0.16	± 0.22	± 0.18	± 0.24	± 0.20	± 0.26
$(3.00) \leq 4.00$	± 0.16	± 0.22	± 0.18	± 0.24	± 0.20	± 0.26	± 0.20	± 0.27
$(4.00) \leq 5.00$	± 0.18	± 0.24	± 0.20	± 0.26	± 0.21	± 0.28	± 0.22	± 0.29
$(5.00) \leq 6.00$	± 0.20	± 0.26	± 0.21	± 0.28	± 0.22	± 0.29	± 0.23	± 0.31
$(6.00) \leq 8.00$	± 0.22	± 0.29	± 0.22	± 0.30	± 0.23	± 0.31	± 0.26	± 0.35
$(8.00) \leq 10.00$	± 0.24	± 0.32	± 0.24	± 0.33	± 0.25	± 0.34	± 0.30	± 0.40
$(10.00) \leq 12.50$	± 0.26	± 0.35	± 0.27	± 0.36	± 0.28	± 0.37	± 0.31	± 0.43
$(12.50) \leq 15.00$	± 0.28	± 0.37	± 0.28	± 0.38	± 0.30	± 0.40	± 0.34	± 0.46
$(15.00) \leq 25.00$	± 0.30	± 0.40	± 0.31	± 0.42	± 0.34	± 0.45	± 0.37	± 0.50

¹⁾ The standard tolerances on thickness are according to the EN 10051 Category A (yield strength $R_{eH} \leq 300$ MPa in the standard).

Width tolerances

Tolerances for nominal width mm											
Ruukki						EN 10051					
Mill edges			Sheared edges GK			Nominal width		Mill edges		Sheared edges GK ¹⁾	
Nominal width	Lower	Upper	Nominal thickness	Lower	Upper		Lower	Upper	Lower	Upper	
≤ 1200	0	+20	≤ 4.99	0	+1.0	≤ 1200	0	+20	0	+3	
> 1200	0	+20	≥ 5.00	0	+1.0	$> 1200 \leq 1850$	0	+20	0	+5	
–	–	–	–	–	–	> 1850	0	+25	0	+6	

The values given in the table for tolerances on thickness and width are not valid for the end sections, of length L.

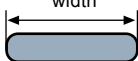

L is derived from the formula $L(m) = 90/\text{nominal thickness (mm)}$; the total length of the two ends but not over 20 m.

¹⁾ The tolerances for coils and slit strip with sheared edges are valid for nominal thicknesses ≤ 10 mm. For nominal thicknesses > 10 mm, the upper allowance is to be agreed in connection of the order.

Geometry

Ruukki	Mill edges	Sheared edges GK
Flatness	Requirements concerning flatness can be agreed at the time of enquiry and order.	Requirements concerning flatness can be agreed at the time of enquiry and order.
Straightness Maximum permissible deviation from a straight line	10 mm/6 m	10 mm/6 m

Measurements

Measurement of thickness	at > 40 mm from edge	at > 25 mm from edge
Coil telescoping	≤ 60 mm	≤ 60 mm
Measurement of width Width is measured at straight angles to the longitudinal edges of the flat		

● **Cut lengths**

The dimensional and shape tolerances for cut lengths are given in tables 4 and 5. The tolerances are in compliance with standard EN 10051. By separate agreement, cut lengths can be delivered with Ruukki tolerances that are stricter than the standard tolerance values. If a delivery of cut lengths with sheared edges is required, the letters GK must be appended to the width dimension. In addition, it is possible to have cut lengths supplied to the length tolerances specified for precision cutting.

Table 4.

Dimensional and shape tolerances.

EN 10111, Hot rolled low carbon steel sheet and strip for cold forming, $R_{eH} = 170 - 360$ MPa. Cut lengths

Thickness tolerances. Tolerances for nominal thickness mm

Nominal thickness mm	Width mm			
	≤ 1200 EN 10051	(1200)-1500 EN 10051	(1500)-1800 EN 10051	(1800) EN 10051
≤ 2.00	±0.13	±0.14	±0.16	–
(2.00) ≤ 2.50	±0.14	±0.16	±0.17	±0.19
(2.50) ≤ 3.00	±0.15	±0.17	±0.18	±0.20
(3.00) ≤ 4.00	±0.17	±0.18	±0.20	±0.20
(4.00) ≤ 5.00	±0.18	±0.20	±0.21	±0.22
(5.00) ≤ 6.00	±0.20	±0.21	±0.22	±0.23
(6.00) ≤ 8.00	±0.22	±0.23	±0.23	±0.26
(8.00) ≤ 10.00	±0.24	±0.25	±0.25	±0.28

Width tolerances. Tolerances for nominal width mm

Ruukki Nominal width	Mill edges		Sheared edges GK		EN 10051 Nominal width	Mill edges		Leikatuin reunoin GK ¹⁾	
	Lower	Upper	Lower	Upper		Lower	Upper	Lower	Upper
≤1200	0	+20	0	+2	≤1200	0	+20	0	+3
>1200	0	+20	0	+2	>1200 ≤ 1850	0	+20	0	+5
–	–	–	–	–	>1850	0	+25	0	+6

¹⁾ The tolerances for cut lengths with sheared edges are valid for nominal thickness ≤ 10 mm. For nominal thickness >10 mm, the upper allowance is subject to agreement in connection with the order.

Length tolerances. Tolerances for nominal length mm

Ruukki Nominal length	Normal		Precision cut		EN 10051 Nominal length	Lower	Upper
	Lower	Upper	Lower	Upper			
≤ 6000	0	+6	-2	+2	< 2000	0	+10
> 6000 ≤ 12000	0	+8	-3	+3	≥ 2000 < 8000	0	+0,005 x nominal length
–	–	–	–	–	≥ 8000	0	+40

Geometry

Ruukki	Mill edges	Sheared edges	Precision cut
Flatness	Maximum permissible deviation from flatness	6 mm/m	6 mm/m
Straightness	Maximum permissible deviation from a straight line	0,5 % of nominal length	0,2 % of nominal length
Squareness	Off-squareness is permissible up to	≤ 1 % of nominal width	–
Cross-measure	²⁾ Up to 5 m length, it must be possible to cut a piece of specified size from the flat	²⁾	≤ 4 mm

Measurements

Measurement of thickness	at ≥ 40 mm from edge	at ≥ 25 mm from edge	at ≥ 25 mm from edge
Measurement of width Width is measured at straight angles to the longitudinal edges of the flat			

Table 5.
Dimensional and shape tolerances.
All steel grades (except EN 10111) and all yield strength classes $R_{eH} \leq 900$ MPa. Cut Lengths

Thickness tolerances. Tolerances for nominal thickness mm ¹⁾

Nominal thickness mm	Width mm ≤ 1200		$> 1200 \leq 1500$		$> 1500 \leq 1800$		> 1800	
	Ruukki	EN 10051	Ruukki	EN 10051	Ruukki	EN 10051	Ruukki	EN 10051
≤ 2.00	± 0.13	± 0.17	± 0.14	± 0.19	± 0.16	± 0.21	–	–
$(2.00) \leq 2.50$	± 0.14	± 0.18	± 0.16	± 0.21	± 0.17	± 0.23	± 0.19	± 0.25
$(2.50) \leq 3.00$	± 0.15	± 0.20	± 0.16	± 0.22	± 0.18	± 0.24	± 0.20	± 0.26
$(3.00) \leq 4.00$	± 0.16	± 0.22	± 0.18	± 0.24	± 0.20	± 0.26	± 0.20	± 0.27
$(4.00) \leq 5.00$	± 0.18	± 0.24	± 0.20	± 0.26	± 0.21	± 0.28	± 0.22	± 0.29
$(5.00) \leq 6.00$	± 0.20	± 0.26	± 0.21	± 0.28	± 0.22	± 0.29	± 0.23	± 0.31
$(6.00) \leq 8.00$	± 0.22	± 0.29	± 0.22	± 0.30	± 0.23	± 0.31	± 0.26	± 0.35
$(8.00) \leq 10.00$	± 0.24	± 0.32	± 0.24	± 0.33	± 0.25	± 0.34	± 0.30	± 0.40
$(10.00) \leq 12.50$	± 0.26	± 0.35	± 0.27	± 0.36	± 0.28	± 0.37	± 0.31	± 0.43
$(12.50) \leq 15.00$	± 0.28	± 0.37	± 0.28	± 0.38	± 0.30	± 0.40	± 0.34	± 0.46
$(15.00) \leq 25.00$	± 0.30	± 0.40	± 0.31	± 0.42	± 0.34	± 0.45	± 0.37	± 0.50

¹⁾ The standard tolerances on thickness are according to the EN 10051 Category A (yield strength $R_{eH} \leq 300$ MPa in the standard).

Width tolerances. Tolerances for nominal width mm

Ruukki		EN 10051							
Nominal width	Mill edges		Sheared edges GK		Nominal width	Mill edges		Sheared edges GK ¹⁾	
	Lower	Upper	Lower	Upper		Lower	Upper	Lower	Upper
≤ 1200	0	+20	0	+2	≤ 1200	0	+20	0	+3
> 1200	0	+20	0	+2	$> 1200 \leq 1850$	0	+20	0	+5
–	–	–	–	–	> 1850	0	+25	0	+6

¹⁾ The tolerances for cut lengths with sheared edges are valid for nominal thickness ≤ 10 mm. For nominal thickness > 10 mm, the upper allowance is subject to agreement in connection with the order.

Length tolerances. Tolerances for nominal length mm

Ruukki		EN 10051					
Nominal length	Normal		Precision cut		Nominal length	Lower	Upper
	Lower	Upper	Lower	Upper			
≤ 6000	0	+6	-2	+2	< 2000	0	+10
$> 6000 \leq 12000$	0	+8	-3	+3	$\geq 2000 < 8000$	0	+0.005 x nominal length
–	–	–	–	–	≥ 8000	0	+40

Geometry

Ruukki		Mill edges	Sheared edges	Precision cut
Flatness	Maximum permissible deviation from flatness	6 mm/m	6 mm/m	6 mm/m
Straightness	Maximum permissible deviation from a straight line	0.5 % of nominal length	0.2 % of nominal length	0.2 % of nominal length
Squareness	Off-squareness is permissible up to	≤ 1 % of nominal width	≤ 1 % of nominal width	–
Cross-measure	²⁾ Up to 5 m length, it must be possible to cut a piece of specified size from the flat	²⁾	²⁾	≤ 4 mm

Measurements

Measurement of thickness	at ≥ 40 mm from edge	at ≥ 25 mm from edge	at ≥ 25 mm from edge
Measurement of width Width is measured at straight angles to the longitudinal edges of the flat			

● **Patterned plates**

The dimensional and shape tolerances for patterned plates are given in table 6. The reference standards are DIN 59220, SEL 014E:1979, SFS 5500 and ASTM A 786. DIN 59220:00/SEL 014E:79 (3-10 mm)/ SFS 5500 is printed on the inspection document.

Table 6.
Dimensional and shape tolerances Patterned plates

Thickness tolerances

Thickness ¹⁾ mm	Upper and lower allowance for each thickness range mm							
	≤1199		1200 – 1499		1500 – 1799		≥1800	
	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower
2.50 – 3.99	+0.38	-0.38	+0.40	-0.40	+0.42	-0.40	+0.46	-0.40
4.00 – 4.99	+0.40	-0.40	+0.44	-0.40	+0.46	-0.40	+0.48	-0.40
5.00 – 5.99	+0.44	-0.40	+0.46	-0.40	+0.48	-0.40	+0.50	-0.40
6.00 – 7.99	+0.46	-0.40	+0.48	-0.40	+0.50	-0.40	+0.52	-0.40
8.00 – 13.00	+0.52	-0.50	+0.54	-0.50	+0.56	-0.50	+0.58	-0.50

¹⁾ Thickness is measured a minimum of 25 mm from edges for basic plate products.

Width tolerances

Lower allowance	Upper allowance	Upper allowance
±0 mm	+2 mm, patterned plates with sheared edges.	+20 mm, patterned plates with mill edges.

Length tolerances

Length mm	Upper allowance mm
≤ 4000	+20
4001 – 6000	+30
6001 – 8000	+40
8001 – 10000	+50
10001 – 15000	+60

Lower tolerance = ±0 mm, patterned plates, sheared and mill edges.

Flatness tolerances

Thickness mm	Tolerance, mm, different gauge lengths	
	Gauge length 1 m	Gauge length 2 m
2.50 – 3.99	9	14
4.00 – 4.99	9	14
5.00 – 5.99	8	12
6.00 – 7.99	8	12
8.00 – 9.99	7	11
10.00 – 13.00	7	11

Permitted deviation from flatness for a gauge length of 0.3–1.0 m is 1% from the gauge length.

Flatness is measured from the middle of the plate a minimum of 25 mm from the edges and 200 mm from the ends of the patterned plate.

Geometry

The edge camber and out-of-squareness	It must be possible to cut a rectangular piece of the ordered size from the patterned plate. It can be separate agreed upon in conjunction with the order that the edge may only deviate from a straight line a maximum of 0.2% of the plate length and that the plate end inclination is a maximum of 1 % of the plate width.
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- **Further information**

The following technical brochures are related to the subject: Plate products, production programme; Coil products, production programme; Patterned plates; Precision cut lengths and precision cut plates with bevelled edge.

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