ALUMINATE

Relevant steelmaking regulation
EUROPEAN STANDARD: UNI EN 10346 : 2015

Areas of use

- Heating
- Irradiation
- Mufflers
- Hobs

Aluminum-silicon coated or aluminized steels

These products consist of a steel substrate over which a coating consisting of aluminum (90%) and silicon (10%) is applied by continuous hot dipping. Their main characteristic lies in their excellent corrosion resistance even at high temperatures: the surface remains unaltered up to 450°C and the 80% heat reflection is crucial when producing heat shielding.

Excellent corrosion protection capability is provided by the aluminum, which, in contact with oxygen in the air, forms a passivating oxide layer.

SURFACE PROTECTION	
C	Chemical passivation
O	Oiling
CO	Oiling and chemical passivation
P	Phosphating
PO	Phosphating and oiling
S	Organic passivation

Technical supply conditions

They can be supplied with special requirements for coating finish, surface appearance and surface protection.

Surface protection can be of different types and must be appropriately indicated when placing the order

The surface appearance can be type A, B or C

SURFACE FINISH TYPES	
A **Coated surface**	Minor imperfections - such as small honeycombs, variations in grain size, dark spots, light scratches, and passivation spots - are possible
B **Improved surface**	It is obtained through skinpass. Small imperfections - such as scratches due to skinpass, streaks, irregularities (not cavities) - are possible with this kind of surface
C **Better quality surface**	It is obtained through skinpass. The best surface does not harm the apparent uniformity of a high color finish class; the other surface must be at least type B

LAM. ALLUMINZED 1.00x125 | DX 53** D + AS
SAMPLE TEXTURE

Coating name	Surface appearance		
	A	B	C
Aluminum-silicon coatings (AS)			
AS060	X	X	(X)
AS080	X	X	X
AS100	X	X	X
AS120	X	X	(X)
AS150	X	(X)	(X)

[a] Surface finishes shown between () are available upon agreement

Coating name	Minimum weight g/m²		Typical values of coating thickness per side in the single spot test µm		Density g/cm³
	Triple spot test	Single spot test	Typical value	Range	
Weight of the aluminum-silicon coating (AS)					
AS060	60	45	10	7 to 15	3.0
AS080	80	60	14	10 to 20	
AS100	100	75	17	12 to 23	
AS120	120	90	20	15 to 27	
AS150	150	115	25	19 to 33	

[a] I g/m2 include both surfaces

MECHANICAL CHARACTERISTICS

Name		Yield stress	Breaking	Elongation	Plastic deformation ratio	Hardening
Quality	**Type of coating:**	**R_e MPa[g]**	**R_m MPa[g]**	**A_{80} % min**	**r_{90} min**	**n_{90} min**
DX51D	+Z, +ZF, +ZA, +ZM, +AZ, +AS	-	270 to 500	22	-	-
DX52D	+Z, +ZF, +ZA, +ZM, +AZ, +AS	140 to 300	270 to 420	26	-	-
DX53D	+Z, +ZF, +ZA, +ZM, +AZ, +AS	140 to 260	270 to 380	30	-	-
DX54D	+Z, +ZA	120 to 220	260 to 350	36	1.6	0.18
DX54D	+ZF, +ZM	120 to 220	260 to 350	34	1.4	0.18
DX54D	+AZ	120 to 220	260 to 350	36	-	-
DX54D	+AS	120 to 220	260 to 350	34	1.4	0.18
DX55D	+AS	140 to 240	270 to 370	30	-	-
DX56D	+Z, +ZA	120 to 180	260 to 350	39	1.9	0.21
DX56D	+ZF, +ZM	120 to 180	260 to 350	37	1.7	0.20
DX56D	+AZ, +AS	120 to 180	260 to 350	39	1.7	0.20
DX57D	+Z, +ZA	120 to 170	260 to 350	41	2.1	0.22
DX57D	+ZF, +ZM	120 to 170	260 to 350	39	1.9	0.21
DX57D	+AS	120 to 170	260 to 350	41	1.9	0.21

[g] 1MPa = 1N/mm²

e = laminate thickness in mm

Tensile tests performed on transverse specimens

ALUMINATE

Relevant steelmaking regulation

EUROPEAN STANDARD: UNI EN 10346 : 2015

Areas of use

- Conditioning
- Refrigeration
- Cars
- Poultry
- Dryers
- Elevators
- Household appliance

CHEMICAL COMPOSITION

Name		Chemical composition max %					
Quality	Type of coating:	C	Si	Mn	P	S	Ti
DX51D	+Z, +ZF, +ZA, +ZM, +AZ, +AS	0.18		1.20	0.12		
DX52D	+Z, +ZF, +ZA, +ZM, +AZ, +AS	0.12	0.50	0.60	0.10	0.045	0.030
DX53D	+Z, +ZF, +ZA, +ZM, +AZ, +AS						
DX54D	+Z, +ZF, +ZA, +ZM, +AZ, +AS						
DX55D	+AS						
DX56D	+Z, +ZF, +ZA, +ZM, +AZ, +AS						
DX57D	+Z, +ZF, +ZA, +ZM, +AS						

MECHANICAL CHARACTERISTICS

Construction steels

Name		Yield stress	Breaking	Elongation
Quality	Type of coating:	$R_{p0.2}$ MPa[d]	R_m MPa[d]	A_{80} % min
S220GD	+Z, +ZF, +ZA, +ZM, +AZ	220	300	20
S250GD	+Z, +ZF, +ZA, +ZM, +AZ, +AS	250	330	19
S280GD	+Z, +ZF, +ZA, +ZM, +AZ, +AS	280	360	18
S320GD	+Z, +ZF, +ZA, +ZM, +AZ, +AS	320	390	17
S350GD	+Z, +ZF, +ZA, +ZM, +AZ, +AS	350	420	16
S390GD	+Z, +ZF, +ZA, +ZM, +AZ	390	460	16
S420GD	+Z, +ZF, +ZA, +ZM, +AZ	420	480	15
S450GD	+Z, +ZF, +ZA, +ZM, +AZ	450	510	14
S550GD	+Z, +ZF, +ZA, +ZM, +AZ	550	560	-

[d] 1MPa = 1N/mm^2

e = laminate thickness in mm

Tensile tests performed on transverse specimens

CHEMICAL COMPOSITION

Name		Chemical composition max %				
Quality	Type of coating:	C	Si	Mn	P	S
S220GD	+Z, +ZF, +ZA, +ZM, +AZ	0.20	0.60	1.70	0.10	0.045
S250GD	+Z, +ZF, +ZA, +ZM, +AZ, +AS					
S280GD	+Z, +ZF, +ZA, +ZM, +AZ, +AS					
S320GD	+Z, +ZF, +ZA, +ZM, +AZ, +AS					
S350GD	+Z, +ZF, +ZA, +ZM, +AZ, +AS					
S390GD	+Z, +ZF, +ZA, +ZM, +AZ					
S420GD	+Z, +ZF, +ZA, +ZM, +AZ					
S450GD	+Z, +ZF, +ZA, +ZM, +AZ					
S550GD	+Z, +ZF, +ZA, +ZM, +AZ					

MECHANICAL CHARACTERISTICS

Name		Yield stress $R_{P0,2}$ MPa[f]	Hardening index BH_2 MPa[f] min	Breaking R_m Mpa[f]	Elongation A_{80} % min	Plastic deformation ratio r_{90} min	Hardening $n^{90\ min}$
Quality	Type of coating:						
	+Z, +ZF, +ZA +ZM, +AZ, +AS	160 to 220	-	300 to 360	37	1.9	0.20
HX160YD		180 to 240	-	330 to 390	34	1.7	0.18
HX180BD		180 to 240	30	290 to 360	34	1.5	0.16
HX220YD		220 to 280	-	340 to 420	32	1.5	0.17
HX220BD		220 to 280	30	320 to 400	32	1.2	0.15
HX260YD		260 to 320	-	380 to 440	30	1.4	0.16
HX260BD		260 to 320	30	360 to 440	28	-	-
HX260LAD		260 to 330	-	350 to 430	26	-	-
HX300YD		300 to 360	-	390 to 470	27	1.3	0.15
HX300BD		300 to 360	30	400 to 480	26	-	-
HX300LAD		300 to 380	-	380 to 480	23	-	-
HX340BD		340 to 400	30	440 to 520	24	-	-
HX340LAD		340 to 420	-	410 to 510	21	-	-
HX380LAD		380 to 480	-	440 to 560	19	-	-
HX420LAD		420 to 520	-	470 to 590	17	-	-
HX460LAD		460 to 560	-	500 to 640	15	-	-
HX500LAD		500 to 620	-	530 to 690	13	-	-

[f] 1 MPa = 1 N/mm²

e = laminate thickness in mm

Tensile tests performed on transverse specimens

CHEMICAL COMPOSITION

Name		C MAX	Si max	Mn max	P max	S max	Al_{total}	Nb max	Ti max
Quality	Type of coating:								
HX160YD	+Z, +ZF, +ZA +ZM, +AZ, +AS	0.01	0.30	0.60	0.060	0.025	≥0.010	0.09	0.12
		0.01	0.30	0.70	0.060	0.025	≥0.010	0.09	0.12
HX180BD		0.06	0.50	0.70	0.060	0.025	≥0.015	0.09	0.12
HX220YD		0.01	0.30	0.90	0.080	0.025	≥0.010	0.09	0.12
HX220BD		0.08	0.50	0.70	0.085	0.025	≥0.015	0.09	0.12
HX260YD		0.01	0.30	1.60	0.10	0.025	≥0.010	0.09	0.12
HX260BD		0.10	0.50	1.00	0.10	0.030	≥0.010	0.09	0.12
HX260LAD		0.11	0.50	1.00	0.030	0.025	≥0.015	0.09	0.15
HX300YD		0.015	0.30	1.60	0.10	0.025	≥0.010	0.09	0.12
HX300BD		0.11	0.50	0.80	0.12	0.025	≥0.010	0.09	0.12
HX300LAD		0.12	0.50	1.40	0.030	0.025	≥0.015	0.09	0.15
HX340BD		0.11	0.50	0.80	0.12	0.025	≥0.010	0.09	0.12
HX340LAD		0.12	0.50	1.4	0.030	0.025	≥0.015	0.10	0.15
HX380LAD		0.12	0.50	1.5	0.030	0.025	≥0.015	0.10	0.15
HX180YD		0.12	0.50	1.6	0.030	0.025	≥0.015	0.10	0.15
HX460LAD		0.15	0.50	1.7	0.030	0.025	≥0.015	0.10	0.15
HX500LAD		0.15	0.50	1.7	0.030	0.025	≥0.015	0.10	0.15

Tolerances by size and shape

The standard applies to flat products with a coating applied by continuous hot dipping of zinc (Z), zinc-iron alloy (ZF), zinc-aluminum alloy (ZA), aluminum-zinc alloy (AZ), and aluminum-silicon alloy (AS), of cold-forming high-strength low-carbon steels, and of structural steels with a minimum thickness of 0.20 mm and a maximum thickness of 6.50 mm

Relevant steelmaking regulation

EUROPEAN STANDARD: UNI EN 10143 : 2006

ATTENTION:

They come in the form of thin metal sheets, wide strips, sheared wide strips, or cut-to-length strips (bands) made from sheared wide strips or thin sheets. **The standards involved are UNI EN 10292, UNI EN 10326, UNI EN 10327, and hot dip-coated products are according to prEN 10336.**

Thickness tolerances for steels with minimum **specified** yield strength **R_e or $Rp_{0.2}$ < 260 MPa**

1

Nominal thickness t	Normal tolerance for nominal width w			Special tolerance (S) for nominal width w		
	≤ 1200	1200 < w ≤ 1500	>1500	≤ 1200	1200 < w ≤ 1500	>1500
0.20 < t ≤ 0.40	± 0.04	± 0.05	± 0.06	± 0.030	± 0.035	± 0.040
0.40 < t ≤ 0.60	± 0.04	± 0.05	± 0.06	± 0.035	± 0.040	± 0.045
0.60 < t ≤ 0.80	± 0.05	± 0.06	± 0.07	± 0.040	± 0.045	± 0.050
0.80 < t ≤ 1.00	± 0.06	± 0.07	± 0.08	± 0.045	± 0.050	± 0.060
1.00 < t ≤ 1.20	± 0.07	± 0.08	± 0.09	± 0.050	± 0.060	± 0.070
1.20 < t ≤ 1.60	± 0.10	± 0.11	± 0.12	± 0.060	± 0.070	± 0.080
1.60 < t ≤ 2.00	± 0.12	± 0.13	± 0.14	± 0.070	± 0.080	± 0.090
2.00 < t ≤ 2.50	± 0.14	± 0.15	± 0.16	± 0.090	± 0.100	± 0.110
2.50 < t ≤ 3.00	± 0.17	± 0.17	± 0.18	± 0.110	± 0.120	± 0.130
3.00 < t ≤ 5.00	± 0.20	± 0.20	± 0.21	± 0.15	± 0.16	± 0.17
5.00 < t ≤ 6.50	± 0.22	± 0.22	± 0.23	± 0.17	± 0.18	± 0.19

Thickness tolerances for steels with minimum specified **yield strength 260 MPa ≤ $Rp_{0.2}$ ≤ 360 MPa and for DX51D and S550GD qualities**

2

Nominal thickness t	Normal tolerance for nominal width w			Special tolerance (s) for nominal width w		
	≤ 1200	1200 < w ≤ 1500	>1500	≤ 1200	1200 < w ≤ 1500	>1500
0.20 < t ≤ 0.40	± 0.05	± 0.06	± 0.07	± 0.035	± 0.040	± 0.045
0.40 < t ≤ 0.60	± 0.05	± 0.06	± 0.07	± 0.040	± 0.045	± 0.050
0.60 < t ≤ 0.80	± 0.06	± 0.07	± 0.08	± 0.045	± 0.050	± 0.060
0.80 < t ≤ 1.00	± 0.07	± 0.08	± 0.09	± 0.050	± 0.060	± 0.070
1.00 < t ≤ 1.20	± 0.08	± 0.09	± 0.11	± 0.060	± 0.070	± 0.080
1.20 < t ≤ 1.60	± 0.11	± 0.13	± 0.14	± 0.070	± 0.080	± 0.090
1.60 < t ≤ 2.00	± 0.14	± 0.15	± 0.16	± 0.080	± 0.090	± 0.110
2.00 < t ≤ 2.50	± 0.16	± 0.17	± 0.18	± 0.110	± 0.120	± 0.130
2.50 < t ≤ 3.00	± 0.19	± 0.20	± 0.20	± 0.130	± 0.140	± 0.150
3.00 < t ≤ 5.00	± 0.22	± 0.24	± 0.25	± 0.17	± 0.18	± 0.19
5.00 < t ≤ 6.50	± 0.24	± 0.25	± 0.26	± 0.19	± 0.20	± 0.21

Tolerances by size and shape

Relevant steelmaking regulation

EUROPEAN STANDARD: UNI EN 10131 : 2006

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The standard applies to flat products with a coating applied by continuous hot dipping of zinc (Z), zinc-iron alloy (ZF), zinc-aluminum alloy (ZA), aluminum-zinc alloy (AZ), and aluminum-silicon alloy (AS), of cold-forming high-strength low-carbon steels, and of structural steels with a minimum thickness of 0.20 mm and a maximum thickness of 6.50 mm

Thickness tolerances for steels with minimum specified **yield strength 360 MPa ≤ $Rp_{0.2}$ ≤ 420 MPa**

3

Nominal thickness t	Normal tolerance for nominal width w			Special tolerance (s) for nominal width w		
	≤ 1200	1200 < w ≤ 1500	>1500	≤ 1200	1200 < w ≤ 1500	>1500
0.35 < t ≤ 0.40	± 0.05	± 0.06	± 0.07	± 0.040	± 0.045	± 0.050
0.40 < t ≤ 0.60	± 0.06	± 0.07	± 0.08	± 0.045	± 0.050	± 0.060
0.60 < t ≤ 0.80	± 0.07	± 0.08	± 0.09	± 0.050	± 0.060	± 0.070
0.80 < t ≤ 1.00	± 0.08	± 0.09	± 0.11	± 0.060	± 0.070	± 0.080
1.00 < t ≤ 1.20	± 0.10	± 0.11	± 0.12	± 0.070	± 0.080	± 0.090
1.20 < t ≤ 1.60	± 0.13	± 0.14	± 0.16	± 0.080	± 0.090	± 0.110
1.60 < t ≤ 2.00	± 0.16	± 0.17	± 0.19	± 0.090	± 0.110	± 0.120
2.00 < t ≤ 2.50	± 0.18	± 0.20	± 0.21	± 0.120	± 0.130	± 0.140
2.50 < t ≤ 3.00	± 0.22	± 0.22	± 0.23	± 0.140	± 0.150	± 0.160
3.00 < t ≤ 5.00	± 0.22	± 0.24	± 0.25	± 0.17	± 0.18	± 0.19
5.00 < t ≤ 6.50	± 0.24	± 0.25	± 0.26	± 0.19	± 0.20	± 0.21

Thickness tolerances for steels with minimum specified **yield strength 420 MPa ≤ $Rp^{0.2}$ ≤ 900 MPa**

4

Nominal thickness t	Normal tolerance for nominal width w			Special tolerance (s) for nominal width w		
	≤ 1200	1200 < w ≤ 1500	>1500	≤ 1200	1200 < w ≤ 1500	>1500
0.35 < t ≤ 0.40	± 0.06	± 0.07	± 0.08	± 0.045	± 0.050	± 0.060
0.40 < t ≤ 0.60	± 0.06	± 0.08	± 0.09	± 0.050	± 0.060	± 0.070
0.60 < t ≤ 0.80	± 0.07	± 0.09	± 0.11	± 0.060	± 0.070	± 0.080
0.80 < t ≤ 1.00	± 0.09	± 0.11	± 0.12	± 0.070	± 0.080	± 0.090
1.00 < t ≤ 1.20	± 0.11	± 0.13	± 0.14	± 0.080	± 0.090	± 0.110
1.20 < t ≤ 1.60	± 0.15	± 0.16	± 0.18	± 0.090	± 0.110	± 0.120
1.60 < t ≤ 2.00	± 0.18	± 0.19	± 0.21	± 0.110	± 0.120	± 0.140
2.00 < t ≤ 2.50	± 0.21	± 0.22	± 0.24	± 0.140	± 0.150	± 0.170
2.50 < t ≤ 3.00	± 0.24	± 0.25	± 0.26	± 0.170	± 0.180	± 0.190
3.00 < t ≤ 5.00	± 0.26	± 0.27	± 0.28	± 0.23	± 0.24	± 0.26
5.00 < t ≤ 6.50	± 0.28	± 0.29	± 0.30	± 0.25	± 0.26	± 0.28

Tolerances by size and shape

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Relevant steelmaking regulation

EUROPEAN STANDARD: UNI EN 10143 : 2006

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Tolerance on sheet and strip width **≥ 600 mm**

5

Nominal width w	Normal tolerance	Special tolerance (s)
600 ≤ w ≤ 1200	+5 0	+2 0
1200 < w ≤ 1500	+6 0	+2 0
1500 < w ≤ 1800	+7 0	+3 0
w > 1800	+8 0	+3 0

Tolerance on belt width **less than 600 mm**

6

Tolerance class	Nominal thickness t	Nominal width			
		w < 125	125 ≤ w < 250	250 ≤ w < 400	400 ≤ w < 600
Normal	t < 0.6	+0.4 0	+0.5 0	+0.7 0	+1.0 0
	0.6 ≤ t < 1.0	+0.5 0	+0.6 0	+0.9 0	+1.2 0
	1.0 ≤ t < 2.0	+0.6 0	+0.8 0	+1.1 0	+1.4 0
	2.0 ≤ t ≤ 3.0	+0.7 0	+1.0 0	+1.3 0	+1.6 0
	3.0 < t ≤ 5.0	+0.8 0	+1.1 0	+1.4 0	+1.7 0
	5.0 < t ≤ 6.5	+0.9 0	+1.2 0	+1.5 0	+1.8 0
Special (s)	t < 0.6	+0.2 0	+0.2 0	+0.3 0	+0.5 0
	0.6 ≤ t < 1.0	+0.2 0	+0.3 0	+0.4 0	+0.6 0
	1.0 ≤ t < 2.0	+0.3 0	+0.4 0	+0.5 0	+0.7 0
	2.0 ≤ t ≤ 3.0	+0.4 0	+0.5 0	+0.6 0	+0.8 0
	3.0 < t ≤ 5.0	+0.5 0	+0.6 0	+0.7 0	+0.9 0
	5.0 < t ≤ 6.5	+0.6 0	+0.7 0	+0.8 0	+0.10 0

Tolerances by size and shape

Relevant steelmaking regulation

EUROPEAN STANDARD: UNI EN 10143 : 2006

ATTENTION:

The standard applies to flat products with a coating applied by continuous hot dipping of zinc (Z), zinc-iron alloy (ZF), zinc-aluminum alloy (ZA), aluminum-zinc alloy (AZ), and aluminum-silicon alloy (AS), of cold-forming high-strength low-carbon steels, and of structural steels with a minimum thickness of 0.20 mm and a maximum thickness of 6.50 mm

They come in the form of thin metal sheets, wide strips, sheared wide strips, or cut-to-length strips (bands) made from sheared wide strips or thin sheets. **The standards involved are UNI EN 10292, UNI EN 10326, UNI EN 10327, and hot dip-coated products are according to prEN 10336.**

Length tolerances

Nominal length	Normal tolerance	Special tolerance (s)
< 2000	+6 0	+3 0
≥ 2000 and ≤ 8000	+0.3 of the length 0	+0.15% of the length 0
>8000	by agreement	

Flatness tolerances for steels with minimum **specified** yield strength R_e or $Rp_{0.2}$ < 260 MPa

Tolerance class	Nominal width w	Maximum wave height for nominal thickness t			
		t < 0.7	0.7 ≤ t < 1.6	1.6 ≤ t < 3.0	3.0 ≤ t ≤ 6.5
Normal	w < 1200	10	8		15
	1200 ≤ w < 1500	12	10		18
	w ≥ 1500	17	15		23
Special (FS)	w < 1200	5	4	3	8
	1200 ≤ w < 1500	6	5	4	9
	w ≥ 1500	8	7	6	12

Flatness tolerance for steels with minimum specified **yield strength 260 MPa ≤ $Rp_{0.2}$ ≤ 360 MPa and for DX51D and S550GD degrees**

Tolerance class	Nominal width w	Maximum wave height for nominal thickness t			
		t < 0.7	0.7 ≤ t < 1.6	1.6 ≤ t < 3.0	3.0 ≤ t ≤ 6.5
Normal	w < 1200	13	10		18
	1200 ≤ w < 1500	15	13		25
	w ≥ 1500	20	19		28
Special (FS)	w < 1200	8	6	5	9
	1200 ≤ w < 1500	9	8	6	12
	w ≥ 1500	12	10	9	14

Tolerances by size and shape

The standard applies to flat products with a coating applied by continuous hot dipping of zinc (Z), zinc-iron alloy (ZF), zinc-aluminum alloy (ZA), aluminum-zinc alloy (AZ), and aluminum-silicon alloy (AS), of cold-forming high-strength low-carbon steels, and of structural steels with a minimum thickness of 0.20 mm and a maximum thickness of 6.50 mm

Relevant steelmaking regulation

EUROPEAN STANDARD: UNI EN 10131 : 2006

ATTENTION:

They come in the form of thin metal sheets, wide strips, sheared wide strips, or cut-to-length strips (bands) made from sheared wide strips or thin sheets. **The standards involved are UNI EN 10292, UNI EN 10326, UNI EN 10327, and hot dip-coated products are according to prEN 10336.**

Out-of-square tolerance

10

The out-of-square (u) is the orthogonal projection of the transverse side along the longitudinal side (see Figure 1).

Out-of-square must not exceed 1% of the sheet width

Lapping tolerance

11

The lapping (q) is the maximum distance between the longitudinal edge and a reference straight side (see Figure 1).

The lapping should be measured on the concave side. The base of the measurement should be 2 meters, taken on any point on the concave edge.

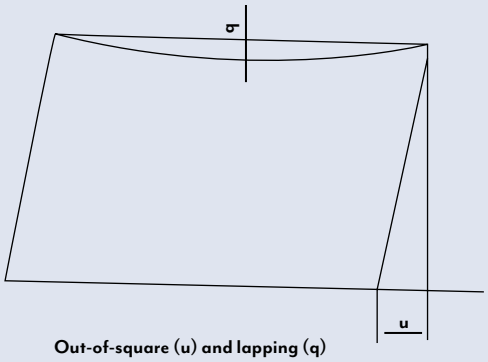
If the metal sheet has a length of less than 2 meters, the base of the measurement should be equal to its length.

Lapping should not exceed 5 mm over a length of 2 meters. For lengths of less than two meters, the lapping should not exceed 0.25 percent of the length itself.

For strips less than 600 mm wide, a special lapping tolerance (CS) of maximum 2 mm on a length of 2 meters can be specified.

This special tolerance is not applicable to strips with minimum yield strength $Rp0_{,2} \geq 280$ MPa.

Figure 1



Out-of-square (u) and lapping (q)